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FEDERAL DEPARTMENT OF JUSTICE ATTACKS RESALE UNDER PATENTED-CARTON PROTECTION.

Suit has been brought in the District Court of the United States for the Eastern District of Michigan, Southern Division, by the United States of America, Petitioner, *vs.* the Kellogg Toasted Corn Flake Company and others. The interest to our readers in this particular suit is because of its involving certain theories with regard to the right of manufacturers and owners to make agreement with their distributors in fixing a minimum resale price upon the product handled. If the contention of the Government's attorneys is upheld and the relief rendered as set forth in their prayer, it explodes the theory that a manufacturer may, through the protection of a patented container, effect substantial agreements with regard to the distribution and selling price of the article held in the container.

The defendant corporation is the manufacturer of a breakfast food sold in great quantities throughout the United States. The corporation, acting through its officers, sells to jobbers cases containing 36 cartons or packages filled with said product, and the Government alleges that the corporation refuses absolutely to sell these goods directly to the consumer or to the retail trade. The jobbers in turn sell said packages by the case to the retail merchants, and by the retail merchants the product is resold by the package to the consumers.

For some time after the business was established the retailer was required to sell each carton or package at a fixed price by a notice enclosed in each case, which recited in substance that the contents of the case were sold with the distinct understanding (which understanding was a part of the consideration of sale), that the package should not be retailed at less than a certain price. Certain penalties, such as as assessment of nominal damages and the assent upon the part of the purchaser to being refused further supply of such goods until such damages were paid, were involved.

Later on, the defendants, according to the petition and prayer of the Government, undertook to invoke the assistance of the patent laws in order to accomplish the same purpose of fixing and enforcing the observance of a retail price by the retail dealer. Patents were secured upon a certain form of carton or container. Upon the top of this carton there is a flap or tongue, and on the flap or tongue a notice is printed to the effect that the package or contents

shall not be retailed nor advertised nor offered for sale at less than a certain minimum price. Retailing the package at less than this price is stated to be a violation of the conditions of sale and an infringement of the corporation's patent rights.

The Government's petition insists that the alleged patented carton can afford no protection to defendants in attempting to fix and enforce the resale price by retailers. It is contended that the carton was not in fact patentable; that the value of the carton is negligible as compared with the value of the contents, and it is the contents alone that is desired by the purchaser and forms a consideration for the contract, the purchase of the carton being a mere incident in the contract of sale. It is also contended that the defendants having sold the carton and contents to the jobbers, and parted with all title thereto, have no legal power to fix the price at which the purchaser from said jobbers can be required to resell the same.

It is contended that the difference in the retail, wholesale and manufacturer's price of the product leaves ample margin for the play of competition between both the jobbers and the retailers. As a result of the selling and distributing plan thus adopted it is alleged that there is no competition between jobbers which can effect the price of the article to the retailer, nor is there any competition between either the jobbers or the retailers which can benefit the consumer by reducing the price to them.

It is held, therefore, that the agreements exacted from the jobbers and the said condition of sale imposed upon and accepted by the retailers, restrain the interstate commerce in this article in that it prevents it from moving in interstate commerce at prices other than those fixed by the defendant company, and prevents all competition between dealers therein which can effect its cost to the retailer or consumer, and they produce a monopoly of said interstate commerce in that they concentrate in the hands of those who abide by the terms of said agreements and conditions of sale the entire traffic in said article and exclude therefrom all dealers who refuse to enter into or abide by said agreements and conditions.

Prayer is made that the defendant corporation and all other officers and agents of the corporation be enjoined from requiring jobbers to enter into an agreement to resell said product at a fixed price per case, and from suggesting to said jobbers in writing or otherwise that if they fail or refuse to observe said fixed price they will be cut off from a further supply of said product, and that on final hearing said injunction be made perpetual.

It is also prayed that the defendant corporation and the individual defendants be enjoined from exacting in any manner an agreement or understanding from the retailers that they shall sell the same at a price fixed by defendants, and especially from packing and selling the product in cartons or boxes having thereon a notice requiring the retailer to sell said carton and its contents at a certain price, or suggest to the retail dealers that if they do not observe the price specified their supply thereof will be cut off. It is prayed that on final hearing this injunction be made permanent.

BRIGHTNESS OF THE VISUAL FIELD.

It has long been known that the sensitiveness of the eye to slight changes in the intensity of light is greatest for lights of low intensity. In fact the difference necessary to perception is roughly proportional to the intensity of the light. The amount of contrast between the object viewed and the surroundings is thus an important element in relation to the sensitiveness of vision and this is particularly true at low intensities. For example, it is much easier to perceive a lighted lantern at a distance at nighttime than upon a bright day.

In comparing the brightness of two objects, or in endeavoring to perceive details, it is often assumed that the entire absence of light from other sources will aid the eye in making the desired comparison, but that this is an erroneous assumption there is much evidence. That the discernment of the details of an object at some distance with a definite illumination is often more easy in the daytime, with an abundance of diffused light in the field, than at nighttime, when the surroundings are entirely dark, is a common experience. In factory work it was at one time considered sufficient to brightly illuminate the object which required the direct attention of the worker, but experience has shown that such local illumination with a dark background not only has the disadvantage of leading to accidents through inability to see well in the poorly illuminated parts of the shop and other disadvantages connected with this element of the situation, but also that it actually causes greater fatigue to the eye, while at the same time creating a necessity for higher intensities of illumination upon the objects viewed. It is now well recognized that general illumination of a factory is not only desirable for other reasons, but that it enables good seeing with a lesser local intensity of illumination and produces less eye fatigue.

In photometer work, where the greatest effort is made by the eye to detect slight differences in brightness, it has been found that greater sensibility is obtained by having a field of equal brightness with the areas being compared, rather than a field which is perfectly dark.

The paper presented by Dr. P. W. Cobb at the convention of the Illuminating Engineering Society last year, gave quantitative evidence upon this point. It was found that with low intensities of illumination the visual acuity was greater with a dark background, but that when the intensity was greater than about one foot-candle, vision was more acute with a bright field than with a dark field. Similarly in his measurements of the perception of differences in brightness it was found that a dark field was prefer-

able with low intensities, but in comparing intensities higher than about four foot-candles, finer distinctions could be made by the eye when the field was brightly illuminated. It would thus seem that for general purposes, and excluding cases in which feeble intensities of light are concerned, the eye can do better work with a bright field such as is represented by a condition of ordinary daylight. The more we study the conditions which affect the functioning of the eye the more we are impressed with the fact that its abilities have been developed to meet the conditions represented by the bright light of day. Consequently, there are few cases in artificial illumination where conditions can be made any better than through an imitation of daylight effects.

THE ANNUAL REVIEW.

On the following pages we publish a review of the developments that have marked progress in every phase of electrical work during 1912. This review is to a great degree compiled from the opinion of many leaders in each branch of work and stands as an authentic chronicle of what has been accomplished during the twelvemonth.

Of special importance is the tabulation of statistics relating to the value of electrical material produced during the year. This exclusive service gives our readers immediate comparative information of a highly valuable nature in estimating the growth of the business in many lines.

Another important feature of this issue is the article on "Central-Station Ice Making." This gives to the central-station manager and commercial engineer invaluable information for practical use in this rapidly growing application of electrical energy.

The Electric Wagon Section will be of particular interest to every central-station manager, engineer, contractor and utility, not only as an adjunct to increasing the power load, but as a means for greatly increasing the demand for many accessories of an electrical nature. During the year the electrical vehicle industry has expanded materially, and with a better understanding on the part of electric central stations of the big possibilities for them in this field, pointed out so clearly by Messrs. Farrington and McMeel on other pages, there is little doubt that the present year will see a most imposing development in the right direction.

USING THE ELECTRIC TRUCK INTENSIVELY.

The electric truck is no exception to other relatively expensive industrial machinery in requiring a high load-factor as a condition of the most economical service per unit of output. This point must be realized to a greater degree in the successful application of battery transportation, and central-station power engineers and electric-vehicle salesmen will do well to emphasize this phase of the subject in the 1913 truck campaign. If the research work of the Massachusetts Institute of Technology in the electric-vehicle field had done nothing else than to expose the economic waste of standstill time in commercial trackless transportation, the industry would still be its debtor.

Every case proposed for electric-truck service should be analyzed to reduce standing time to the lowest possible terms. Only by so doing can the equipment be made to show to best advantage, and to turn off a larger volume of work per day than is possible with the horse or with the gasoline truck, inside the proper radius of action. Every engineer who has made studies of electric delivery service knows that in too many cases the loading and unloading facilities accorded are entirely inadequate; that the routing is often an inheritance of easy-going horse-traction days, and that without the use of power hoists and higher-speed freight elevators, the addition of modern lighting and the provision of larger platform spacing, the possible economies of a motorized transportation are much reduced.

If street conditions at the loading and unloading points cannot be improved along the lines of widening thoroughfares, it is still within the bounds of reasonable investment to secure some of the above betterments. Their cost will be an insignificant proportion of the truck investment, and as more machines are added the benefits will be still further realized.

There is no longer any excuse for the use of hand lanterns around express stations, shipping departments and wagons of the power-driven type. The installation of a high-powered tungsten lamp at every doorway in a warehouse served by motor trucks is a trifling expense, but it is a positive factor in cutting down the standing time which is so fatal to the proper showing of the equipment. Providing drivers with pocket flash-lamps for use at the doorways of business houses and residences is also a small expense, even including maintenance, compared with the cost of time otherwise lost in working a truck or delivery outfit. Still another possible saving in time may be accomplished by paving the shipping yard smoothly so that the trucks are not obliged to incur delays through slower running. In some industrial truck garages the inspection pits are inconveniently located and are insufficiently lighted; in other cases, the owner has not been shown in black and white how much of a saving would be made in the unit delivery cost if an extra battery were maintained for certain equipment. In short, the electric truck should be given a fair chance to show what it will do under favorable conditions, so far as those conditions may be provided, and it devolves upon the central-station power engineer or electric-vehicle specialist to use every effort to encourage the intensive use of such apparatus, in order that it may yield up its full measure of service, pressed down and running over.

Street Lighting Discussed in Pittsburgh.

A joint meeting of the Pittsburgh Sections of the Illuminating Engineering Society and the American Institute of Electrical Engineers was held on December 12. The subject under discussion was "Street Lighting."

E. L. Farrar, chairman of the American Institute Section, opened the meeting and turned it over to H. S. Hower, chairman of the Illuminating Section.

In the absence of the author, Professor Hower read the paper on "Gas and Gasoline Lighting." The paper was illustrated by lantern slides and was intended to show the superiority of gas over electric lighting.

The second paper was on "The Illumination Requirements of First-Class Streets as met by Arc and Tungsten Light Sources," by C. E. Stephens.

A paper by C. A. B. Halvorson on "New Types of Ornamental Luminous Arc Lamps for the Lighting of Park Ways, Business and Residential Streets," was read by C. J. Mundo.

In the discussion, H. N. Mueller expressed surprise at some of the figures given in the paper on gas lighting.

Berford Brittain spoke of the use of quartz-tube lamps in street lighting. Some are now being tried out in Chicago. Their use is handicapped somewhat by the fact that the lamps can be used only on a direct-current multiple circuit or on an alternating-current multiple circuit through a rectifier.

W. E. Reed said that high-pressure gas is used considerably in Europe. The high pressure increases the candlepower, range and efficiency of the gas units, and higher candlepower lamps are obtainable than is the case with electricity. High intensities are desirable in down-town lighting in cities, but in residential districts so much light is likely to be intercepted by the foliage that the smaller-candlepower tungsten, hung lower and more frequently, are better adapted. Where arc lamps are hung 22 feet high, overhead distribution can be used. For tungsten lamps 12 feet high, underground must be used. Underground must be used for both in the business section. In high-pressure gas lighting, electrically-driven compressors are used. In the daytime the pressure is lowered and only a pilot light burns in the gas unit.

Alan Bright asked what success has been met with in the use of magnetic control of the gas supply? Clock mechanism has been devised; what success has it met with? In tungsten ornamental lighting, post design should be given attention. In many instances posts have been made to embody local traditions. Mr. Bright suggested using same poles for trolley support and lighting to minimize the number of poles on the street.

Mr. Darrah compared the light obtained from incandescent and luminescent sources.

Mr. Magdsick pointed out that the candlepower distribution of the gas unit is circular. The inverted mantle has not much advantage over the upright because although the intensities under the lamp are higher the minimum between lamps is lower. Although gas has been used extensively in residential street lighting, the advent of the tungsten lamp has brought about a great change in the situation. In Cleveland the cost of a gas unit is $20.71. The 60-candlepower tungsten lamp is $10.81 at two cents per kilowatt-hour; $14.00 at three cents, and $17.21 at four cents. In service, gas lamps show very much less than their rated values.

Mr. Stephen's paper advocated ratios of maximum to minimum intensities of 10 to 1 and 5 to 1 for residence and down-town districts, respectively. The four-ampere luminous arc lamps, 400 feet apart, give a ratio of minimum to maximum of 0.0012. Five 60-candlepower tungsten lamps would have about the same cost and would have a ratio of 0.03. As regards down-town lighting the effect produced is of importance. It is desired to get people out and attract them to stores. A festive appearance is desirable. Windows must have higher intensities than street lighting. The ornamental luminous arc with a horizontal candlepower of nearly 1,000 will require intensities in the windows of about 80 foot-candles to secure proper contrast when 20 foot-candles is enough with tungsten post lighting. In residential districts there is economy in the use of low-candlepower tungsten lamps. Trees and spacing contribute to their advantageous use.

Old Central-Station Company Dissolves.

The officers and stockholders of the Tiffin Edison Electric Illuminating Company, which has been in existence for more than a third of a century, met Monday, December 23, in the Tiffin National Bank Building and dissolved. The stockholders will receive a small dividend. This company was one of the pioneer incandescent companies of the middle west. Soon after the establishment of the plant electric lights were installed in St. Paul's M. E. church, which had the honor of being the first church building west of the Allegheny Mountains to be thus illuminated. The company was finally absorbed about two years ago by the Ohio Light & Power Company.

Reduction in Cable Rates.

The Great Northwestern Telegraph Company announces that, commencing January 1, 1913, the rate on deferred cable messages between Canada and Great Britain and Ireland has been reduced to nine cents, messages being subject to delivery within 24 hours of the time filed.

Effective the same date, the company will also reduce the rate for cable letters to 75 cents for 12 words and five cents for each additional word; and the rate on week-end letters will be made $1.15 for 24 words and five cents for each additional word. Delivery of cable letters will be made the following day and week-end letters on Monday, in each case 24 hours earlier than at present. These charges include telegraphic transmission to the cable terminal at Montreal, and cable and week-end letters may also be written in plain language of the country of destination as well as the country of origin.

St. Louis Company Section Meeting.

The regular monthly meeting of the Union Electric Light and Power Company Section of the National Electric Light Association was held at the City Club rooms, St. Louis, Mo., on December 20, 1912. The meeting was called to order by President Hull. J. F. Dechant, of the Sheldon School of Chicago, entertained the meeting with an interesting illustrated talk on "The Science of Business Getting." Upon conclusion the speaker was tendered a vote of thanks. Music, both instrumental and vocal, was furnished for the occasion by the Union Electric Orchestra and the Glee Club.

Free Space for School Exhibits at the Peoria Electrical Show.

The Peoria Show Association has announced that space will be allotted at the Peoria Electrical Show, to be held at the Coliseum January 18 to 25, for the free exhibition of electrical apparatus made by amateurs attending school. A contest will be conducted, a committee of prominent electrical men being appointed to decide upon the merits of the apparatus.

Those winning the awards will be given a cash prize.

Edison Medal Awarded to William Stanley.

By a unanimous vote of the members of the Edison Medal Committee the fourth Edison medal has been awarded to William Stanley, of Great Barrington, Mass., "for meritorious achievement in invention and development of alternating-current systems and apparatus."

Ray Palmer.

In appointing Ray Palmer to the position of city electrician eight months ago, the mayor of Chicago is reported to have remarked that he did not know what Mr. Palmer's politics was, but that he appeared to be an electrical engineer who could be depended upon to look after the city's interests along electrical lines in an efficient, conscientious manner. Although Mr. Palmer is still among the youngest men prominent in the electrical engineering field, his training and experience were such as to fully justify such an estimate of him. Moreover, what he has already accomplished in his present position is convincing evidence that this estimate was a correct one.

Mr. Palmer was born in Sparta, Wis., 34 years ago, and was graduated from the University of that state in 1901. His first position as an electrical engineer was with J. G. White & Company. For this company he was assistant superintendent in the installation of street lighting in New York, spending a year in this work. The company then sent him to London to be one of its engineers there. After two years in England, he returned home and accepted a place as engineer for the Union Traction Company, in Chicago, a concern which has since been merged in the City Railways Company. Resigning this position in 1906, he took up the work of consulting electrical engineer in Chicago and Milwaukee, in which business he continued until his appointment as city electrician of Chicago.

The office of city electrician places its incumbent at the head of the municipal department of electricity, which has charge of the inspection of all electric wiring, takes care of the fire alarm and police telegraph and of all public lighting, and looks after any other matters of an electrical nature with which the city is concerned. The department now includes some 400 officers and employees.

Before becoming the head of the department of electricity of the city, Mr. Palmer had already gained recognition as a specialist in problems concerning electrolysis, and perhaps his most notable work for the city up to the present time has been in connection with securing adequate protection of water pipes and the like from the destructive effects of stray electric currents. His activity in this direction caused him to have to meet arguments of some of the best engineering ability to be obtained, and his method of handling the matter showed him to be master of the subject in hand. This was a piece of work which was given considerable prominence in the technical press at the time the electrolysis ordinance framed by him was pending before the city council last summer. He has also been very active in carrying out improvements in the lighting of the streets of Chicago and in efforts to secure changes in and additions to the city fire alarm system which he considers desirable.

Among the engineering societies of which Mr. Palmer is a member are the American Institute of Electric Engineers and the Western Society of Engineers.

Ray Palmer.
City Electrician, Chicago, Ill.

It may be well said of him further that he is a public official who does not allow any exaggerated notion of the dignity of his position to interfere with his helping any citizen whom it is his place and opportunity to assist. This is an asset of no mean value to the public. He impresses one as being peculiarly fitted by temperament as well as by professional training for the duties of the responsible office which he holds.

Mr. Palmer is a member of the City Club and the Kappa Sigma Greek letter fraternity.

Jovians Meet in Seattle.

The Sons of Jove, of Seattle, Wash., held a luncheon meeting on December 20, with nearly 100 members present. An address was delivered by F. M. Larned, secretary of the Public Service Commission, of Washington, telling of the work of the Commission. He told of the organization of the Commission and referred in detail to the orders which had been entered affecting the electric utilities of the state.

There are in the State of Washington, altogether, 1,789 utilities coming under the authority of the Commission. Of these 121 are electric light and power companies and 102 are telephone or telegraph companies. During the first eleven months of 1912 the Commission had entered 98 orders, of which eight affected telephone companies and one was a general order covering gas, electric and water companies, and promulgating rules regulating their operation. He told of the amendments to the public-utility law which had been recommended to the Legislature by the Commission, as detailed upon another page, and wound up with a discussion of the wider philosophical aspect of publicity regulation.

Wireless Telephony.

A test was recently made at Rome of the apparatus of Professors Moretti and Vanni for telephoning without wires. Calls were made from Rome to the wireless station at Penzano, Maddalena, Palermo and Trapani with entire success. Palermo is in the island of Sicily, about 250 miles from Rome. This invention has been presented to the Italian government and will be used by the army and probably made a monopoly. It is expected to operate with a station in Tripoli without difficulty.

Further Electrification of Pennsylvania Railroad.

It is stated that the branch of the Pennsylvania Railroad between Philadelphia, Pa., and Washington, D. C., will be electrified within two years. Power will be obtained from a new plant to be erected at Conowingo, on the Susquehanna River. Sites for transforming and switching stations have already been acquired between Baltimore and Washington, it is reported.

Northwest Station of the Commonwealth Edison Company.

A joint meeting of the Electrical Section, Western Society of Engineers, the Chicago Section, American Institute of Electrical Engineers, and the Commonwealth Edison Section, National Electric Light Association, was held at Association Auditorium, Chicago, on the evening of December 23. Professor Woodworth presided. A large number of members of these three bodies were present, and heard a very interesting paper presented by W. L. Abbott, chief operating engineer of the Commonwealth Edison Company. The paper dealt with the company's new Northwest Station, an illustrated description of which appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 16, 1911.

Mr. Abbott's paper not only described the physical side of the Northwest Station, but showed in an interesting way the method in which the site of that large generating plant was chosen. There has been a change in location requirements of such a station corresponding with the development of the art in general. These requirements were quite fully covered. The older stations, Mr. Abbott stated, had to be located at the center of load as nearly as might be possible, owing to the large investment necessary for long and heavy distributing lines. With the use of alternating current at higher voltages the expense of constructing transmission lines was necessarily smaller, and the dominant factor in the location of a large station was its accessibility to fuel. In finding a suitable location for Northwest Station the two largely considered points were the accessibility to fuel and water and from these as well as every other standpoint the most desirable site was the plot of 109 acres on the north branch of the Chicago River.

It was necessary to chose a site sufficiently large for two unit stations each capable of generating 120,000 kilowatts. Even with that estimate it seemed probable that in five years, or by 1916, the stations would be running up to their full rated capacity.

The author described the equipment of the station in a complete manner, taking up the boiler room, turbine equipment, reactance coils, etc., illustrating each phase of the subject with excellent lantern slides.

Special attention was called to the fact that, although the equipment of the entire plant was the most modern and efficient when work was commenced, it has even at this early date been improved upon. The Parsons turbine chosen for the addition to the Fisk Street Station is of considerably larger size and higher efficiency than the 20,000-kilowatt machines selected for the Northwest Station.

In discussing the paper Bion J. Arnold reviewed the great advances that have been made in central-station design, mentioning the fact that only a few years ago thermal efficiencies of five or six per cent were considered to be very good. The New York Central stations designed by Mr. Arnold showed an efficiency of about nine per cent, while in the improved Fisk Street Station a figure of ten per cent was reached. Mr. Arnold added that he expected to see a thermal efficiency of a little more than eleven per cent reached, permitting the generation of power at a lower cost than is possible in any other coal-operated central station in the world. Concluding his remarks he complimented the designers of the new station on their adoption of the duplicate-unit idea and the consequent elimination of duplicate systems of pipes, valves, and equipment necessary to provide for the continuous operation of an excessively large station operating as a single unit. Others joining in the discussion were George H. Lukes, G. T. Seely and P. Junkersfeld.

The business part of the program consisted in the nomination of R. F. Schuchardt as chairman of the Electrical Section of the Western Society, F. J. Postel as vice-chairman, and P. B. Woodworth as member of the Executive Committee.

Water Powers of California.

The California Conservation Commission, authorized by an act of the legislature to make an investigation of the natural resources of the State, found that it required information concerning the water resources at the earliest possible date and therefore entered into an agreement with the United State Geological Survey, by which the Survey undertook special investigations of stream flow and water power under an allotment of $12,500 of the commission's appropriation.

The State Board of Control (Water Powers), authorized by an act of the legislature to make a special study of the available water powers of the State and to recommend legislation for their control, likewise entered into a co-operative agreement with the Geological Survey to compile a complete digest of all available data concerning the flow of streams in the State of California and made an allotment for that investigation of $4,000.

The results of the work thus undertaken are being published by the Geological Survey in six volumes designated Water-Supply Papers 295 to 300, inclusive. Nos. 295, 296, and 297 are hydrographic gazetteers containing information concerning all streams, lakes, ponds, and other bodies of water within the State. Nos. 298, 299, and 300 contain the results of all stream-flow measurements that have been made within the State.

The State Board of Control (Water Powers), finding itself in need of accurate information concerning the fall of the principal rivers of the State, made a further allotment to the Geological Survey for special profile surveys of the Pit, Middle Fork of Feather, three forks of the American, the Tuolumne, and the San Joaquin Rivers, allotting therefore the sum of $10,600.

The California State Water Commission, which succeeded the Board of Control (Water Powers), has recently entered into an agreement for the further pursuit of stream-flow investigations under an allotment of $3,500.

All this work above described, together with that which has been carried on in previous years under co-operative agreement between the Survey and the State Engineer, will make available to the people of California practically complete information concerning the water resources of the State, the actual value of which has already been demonstrated to be many millions of dollars and the future value of which will overrun all estimates that may at the present time be considered reasonable.

Electrification of Suburban Lines Around Bombay, India.

The steam railways centering at Bombay, India, have seriously taken up an investigation as to the electrification of their local lines. The railways concerned are the Great Indiana Peninsular Railway, the Bombay, Baroda & Central India Railway and the Bombay Port Trust. The engineer who has been making studies of the railway electrification in the neighborhood of Melbourne, Australia, has accepted the invitation to make this new inquiry. The railways are disposed to adopt a uniform system so as to facilitate interchange of traffic. They are also inclined to divide the expense pro rata. There is a probability that electric power may be obtained from the Ghat hydroelectric works, although the possibility of erecting a separate generating station will be considered. One of the railways in particular is now face to face with the problem either of electrifying its Bombay lines or of greatly increasing its trackage and terminal facilities in order to handle the rapidly increasing traffic.

Wireless Christmas Greetings.

For the first time in history a wireless Christmas greeting was flashed on December 25 from Mare Island Navy Yard, on the Pacific Coast, to Washington, D. C. The message was from Captain Mayo, the commandant of the Mare Island Navy Yard, and was received by the giant radio station at Arlington. It conveyed the wishes of Captain Mayo and other officials at the Navy Yard to the Secretary of the Navy and the officers of the Navy and Marine Corps for a Merry Christmas and Happy New Year.

A Review of the Year in the Electrical Industry.

Similarly to a year ago there is little in the way of startling development to chronicle in connection with the progress of the science and art of electricity during the current year. The improvement in business that set in toward the end of 1911 has continued without perceptible secession and in every department of activity report has it that at least so far as volume is concerned, the industry is enjoying a period of much prosperity. In some lines there has been an unprecedented increase in the amount of material produced and awaiting shipment, but while there has been a high percentage of increase in material activity, prices have not gotten around to a point where the financial gain has been commensurate with the general improving trend of business.

On the following pages we will review the outstanding developments, taking them up as broad divisions of the whole domain of electrical activity. This review has been contributed to by a number of leaders in the industry. The paragraphs that follow reflect to a great degree their opinion as to what have constituted the essential advances in the subjects with which they are most familiar. In many cases these contributors have not wished to be quoted, and in deference to them no signatures are attached to the data assembled herewith. To all those, however, who have contributed in any measure to this review we now extend our sincere thanks.

Telephony and Telegraphy.

During the year the American Telephone & Telegraph Company announced a system of pensions, disability and sick benefits, setting aside a fund to be available on January 1, 1913, of $10,000,000. Over 175,000 employees of the American Telephone & Telegraph Company, the Western Union Telegraph Company and the Western Electric Company will participate in the benefits provided by the movement from this fund, which will be made good each year by the parent organization.

The telephone has seen increased use in train dispatching, a number of steam railroads having adopted this, together with special systems of selective signaling and dispatching in connection with their through train and zone train operating.

With one exception, it may be stated that the year 1912 has been one devoid of startling developments in the electrical transmission of intelligence, but, notwithstanding this, it has been one of constant, healthy growth. The one exception is the acquirement by the Western Electric Company, at very large expense, of certain of the patent rights covering automatic and semi-automatic telephony. The Western Electric Company, the manufacturing arm of the Bell interests, purchased the patent rights of the Lorimer-Lundquist Company, consisting of inventions by George W. Lorimer and others, on the fundamental features of automatic telephony. In addition to this, the Western Electric Company acquired a license under the Clement "Automanual" patents, owned by the North Electric Company, and also made a similar arrangement with the Stromberg-Carlson Telephone Manufacturing Company looking for the acquirement of its automatic patent rights.

It is understood that considerably over a million dollars in cash was involved in these three transactions alone. This would seem to indicate a plan on the part of the Bell interests, looking toward the control of the automatic and semi-automatic situations, even if they do not intend to enter those fields actively.

No advances of moment have been made in manual switchboard operation. The various manufacturing companies are either working toward the automanual or full automatic systems, or, in the case of the smaller companies, are getting out of the telephone switchboard business altogether. The decision of the Stromberg-Carlson Telephone Manufacturing Company to dissolve and leave their field is the most important illustration of the latter tendency.

Among the operating companies consolidation and absorption has been the order of the day. The most notable event of this kind is the purchase of the Bay Cities Home Telephone Company, operating in San Francisco and the neighboring cities, by the Pacific Telephone & Telegraph Company. Other important deals in this same direction were made in the East and Middle West, and others are rumored.

No one who has been watching the situation can question the fact that the Bell interests are rapidly gaining in their evident aim completely to control the telephone situation in this country. Even if this marks the beginning of the end of the so-called Independent movement, no true student of the situation can doubt the fact that that movement has been an important factor in the development of telephony, not only in this country, but the world over. It is true that competition, particularly in such matters as a public utility, involves economic waste, but, on the other hand, with human nature constituted as it is, could any other agency than competition have brought about the changed conditions in which we now find ourselves? In this connection, it is well to point out that many of the most marked improvements in the telephone art have been due to the Independents. The automatic, the semi-automatic and the automanual methods of working all came into being outside the Bell ranks, as did, also, the two-wire multiple switchboard and a host of minor improvements.

In telegraphy there have been no outstanding important developments, but continued betterment of service is to be noted under the new regime, wherein telephony and telegraphy go arm in arm. No one can successfully deny the advantages in having the same network of trunk wires available for both telegraphic and telephonic purposes, and continued betterments are to be looked for as a result of the continuance of this general method of working. One hopeful sign is that there seems to be an increasing tolerance among the telegraph people for the general idea of automatic high-speed telegraphy. When this tolerance is supplanted by action, as it surely will be, then we may look for still better things.

Very large extensions of the loading of No. 8 gauge circuits and of the phantoming of such circuits, as well as the loading of the phantom thus created, have been made in the plant of the American Telephone & Telegraph Company and the associate companies during the past year. A network of loaded No. 8 circuits has been completed, tying together with wires of very high transmission efficiency all of the important centers east of the Rocky Mountains. Steps are now under way looking to the extension of the long-distance lines, which have already been carried as far as Denver, from that point to the Pacific coast, thus furnishing transcontinental telephone lines. It is expected that these lines will be completed within about two years and that by means of them it will be possible to give service across the continent.

The very important work of laying a through underground cable between Boston and Washington is nearing

completion. The underground conduit for this project is entirely completed and the cable is all laid except a stretch between Hartford and Providence. This stretch is to be completed early in 1913, and upon its completion there will be through underground cable conductors from Boston to Washington—a distance of about 450 miles. These circuits will be available to furnish additional conductors between points along the route and to insure the service against interruption due to the destruction of overhead wires by storms. The cable along this route is an embodiment of the very latest developments in the construction of duplex cables, that is, cables the conductors of which are arranged for phantom-circuit working and also representing the highest development in the loading of underground cable conductors, both physical and phantom.

To meet the demand for larger and larger numbers of telephone circuits in the more congested sections of our larger cities, extensive work has been under way for some time in the development of an underground cable containing more than 600 pairs of conductors—the largest standard cable at the present time. This development work is nearing completion, and it is expected that as a result of it there will be available a 900-pair cable of 22 B. & S. gauge wires. The use of such a cable will necessarily be somewhat limited, as in a great many situations the requirements for circuits are not such as to warrant its use. In the most congested areas, however, this cable will have a valuable place.

Wireless Telegraphy and Telephony.

The most important developments have not been along the lines of new apparatus or invention, the advance along these lines being confined to minor refinements in the matters of convenience of operating, rapid changes of wave-length, etc. Much of the obsolete equipment is being dropped and replaced by the more modern apparatus, which has resulted in a diminution of the unnecessary interference formerly so common.

Among the most important occurrences in the wireless world have been the meeting of the International Wireless Congress in London, and the introduction of government regulation in the United States. This regulation was most accelerated by the popular feeling which was aroused at the time of the loss of the *Titanic* which showed conclusively the dangers of the former lawless condition.

Among the great plans of wireless development which have been determined upon during the past year is that of building a chain of wireless stations connecting the United States with the Canal Zone and with the Philippines. The station at Arlington, near Washington, is now practically completed and under test, while the other stations not yet built are expected to be situated in the Canal Zone, San Francisco, Honolulu, Guam, and at some point in the Philippines. The power and character of these other stations will depend largely on the results of the tests of the Arlington station. England has made similar plans for a chain of stations connecting all her possessions, using the Marconi system. The English plan has met with considerable opposition in Parliament and it does not seem at all certain, at the present writing, that it can be carried out in its original form. This development and that also on the Continent is covered by Messrs. Bridge and Durand on other pages. There has been considerable encouraging experimental work along the lines of high-frequency alternating-current generators for the direct production of electrical waves. The most interesting of these are the generators of Professor Goldsmith, of London, and that produced by the Telefunken Company of Berlin. These are still in the experimental state, but if found practicable for use on a large scale, that is, for producing several hundred kilowatts, they will undoubtedly revolutionize long-distance wireless transmission.

The importance of the reflection type of high-frequency alternator is still open to some question, owing to its rather low efficiency at any high order of reflection. It is perhaps interesting to note, that the supposedly modern multiplication of frequency by utilizing such rotor-stator reactions is indeed very old, having been suggested by Trouton in 1891, and it is still more curious, perhaps, that Mr. Trouton suggested it for wireless telegraphy, an art which is usually considered as less than twenty years old.

Although the Goldsmidt alternator is now being installed for transatlantic work, and the Fessenden-Alexanderson high-frequency alternator is in extensive experimental use, the only present commercial working with undamped waves has the arc as its source. In this country, the Federal Wireless Telegraph Company has a number of arc stations scattered through the West and Southwest, and a pair of high-power arc stations at San Francisco and Honolulu, which are in night and day communication. It has been stated on excellent authority that the Honolulu station has been clearly read at the big station at Arlington, near Washington,—a record distance for undamped-wave working.

The majority of smaller installations, however, are today of the quenched, or impact-excitation type, employing a spark or group frequency of about 1,000 cycles per second. This is an interesting example of reversion to very early practice, the single tuned oscilating and radiating circuit of Lodge. The Lodge system of 1896 consisted of a simple aerial circuit including inductance, and sometimes made more persistent by the use of a counterbalance in place of an earth connection. Several years later, Braun, Fessenden and Marconi developed a two-circuit system, in which a very persistently oscillating closed circuit was coupled to the radiating or aerial circuit, and the widespread adoption of this made us lose sight of the simple Lodge circuit. Now, with the quenched system, practice has returned to a single oscillating circuit, which is also the radiating circuit, excited by impact from a non-oscillatory discharge circuit.

A most important advance in wireless telegraphy during the current year is the proper development of long-distance sending and receiving apparatus as arranged by Commendatore Marconi. By this means England has been and is in constant communication via Clifden, Ireland, with Glace Bay, Canada, the apparatus having been in constant use all the time. In connection with this, another most important development is the duplex sending and receiving which is now almost completed at Clifden and Glace Bay stations, by which means messages are sent and received in the same stations at the same time.

From the commercial point of view the most important development was the taking over by the Marconi Wireless Telegraph Company of America of the assets of the United Wireless Telegraph Company, which was bankrupt, as thereby the working of all ships flying the American flag is controlled by one company to the great advantage of shipowners and others.

Wireless regulation has taken a very decided forward step, particularly in this country. The Alexander substitute for the Hitchcock bill was passed in June. This makes it unlawful for any vessel carrying 50 or more passengers operating on the Great Lakes, or leaving an American port without a radio equipment capable of transmitting wireless at least 100 miles either night or day, two skilled operators, one or the other of whom must be on duty at all times while the vessel is being

navigated, being one of the provisions. The bill provides that insofar as vessels navigating the Great Lakes were concerned it would take effect April 1, 1913; with cargo boats July 1, 1913, and other vessels October 1, 1912.

On August 16 the Bourne wireless bill was signed by President Taft. Under the provisions of this bill no radio station will hereafter be allowed to be established within 15 nautical miles of the naval or military stations at Arlington, Key West, San Juan, San Diego, North Head, Tatoosh Island, and the Canal Zone, the Government stations to arrange for the handling of commercial messages under the provisions of the Berlin convention at rates subject to Congressional control. All persons operating commercial radio stations in interstate commerce or with foreign countries, or upon any American vessel engaged in interstate or foreign commerce, must take out a Federal license. This act became effective December 13, 1912.

Announcement was made during the year of the successful use of the wireless detector for the foretelling of approaching storms, an observation post being erected at La Rochelle, France, by Professor Tourpain of Potiers University.

In wireless telephony toward the close of the year announcement is made of some considerable development. The system of Moretti and Vanni has been tried out successfully in Rome, Italy, and excellent communication carried on with stations at Palermo and other places to a distance of about 250 miles. Another system attracting much attention quite recently is that of Bethenod, who has succeeded in increasing the length of the wave given off by an antenna without increasing the length of the antenna itself. This he does by including induction coils so arranged that their use does not involve the loss of energy and with this new form of antenna he uses a double-phase generator, all sparks and intermediary devices being suppressed. It is understood that with the new sparkless apparatus it becomes also much easier to tune the transmitter and receiver, facilitating selective transmission. Bethenod claims that with his new system and apparatus the problem of wireless telephony becomes easy of solution and holds forth the possibility of trans-oceanic communication of speech in the near future.

Electric Lighting and Illuminating Engineering.

Progress in practically all branches of electric lighting during the year just closed was in unpretentious but steady strides that indicate a strong forward movement. This was materially aided by the general re-equipment of the lighting hosts with the newest and most efficient weapons in the shape of lamps and accessories, so that with paraphernalia better adapted to the work and with renewed courage they made such successful onslaughts on the strongholds of their competitors that electric lighting prevails much more generally than ever before.

All of the newer electric lamps were further improved during the year and this general tendency, coincident with and largely the cause of a decided cheapening of electric lighting, continues to bring about the retirement of the older electric lamps, the substitution of modern electric light-sources for gas and other competitive illuminants and the much more liberal use of artificial light.

Probably the most important development in this line is that which has occurred in the incandescent-lamp field. Tungsten lamps have been quietly improved in so many particulars that it would be impossible to deal with them here in detail; among the more striking developments are the practical elimination of blackening of the bulb, further improvement of the ruggedness of the filament, increase in the useful life of the lamp, production of small 110-volt and 220-volt lamps and greater range of sizes available for all voltages, so that tungsten lamps are now adaptable to every purpose for which an incandescent lamp has heretofore been used and to many purposes for which it was formerly considered impossible to use such lamps.

Together with improvements in the quality and reduction in price of tungsten lamps, there was inaugurated last fall by a powerful lamp organization a strong and concerted stimulation campaign which is giving merited publicity to the advantages of these lamps and furthering the widespread movement toward their adoption to the exclusion of all other kinds of filament lamps that became so general last year. This is producing one of the most striking changes that has ever occurred in the incandescent-lamp industry. The carbon-filament lamp, for so many years the standard type, is now practically dead. The useful career of this lamp, as well as that of the tantalum, ended with a suddenness that was almost startling. Gem lamps, which replaced many carbons last year, cannot last long in the face of the steady improvement in quality and reduction in price of tungsten lamps. Within the next year there will undoubtedly occur further improvements in the quality of these lamps of such a nature that they will sweep the older lamps from practically every class of service.

Prior to 1912 tungsten lamps were already in very extensive use for office, store and street lighting; during the last year they became more generally employed in factory, residence, sign, miniature-lamp, hotel, auditorium, train and street-car lighting. Probably the most noteworthy indication of the trend of things is the rapidly extending use of tungsten lamps for industrial illumination, it having been shown that these one-time fragile lamps can withstand even the severe vibrations of most workshops and give better results from every standpoint than arc lamps or any type of combustible illuminant; in some instances it has even been shown that the performance of flaming arc lamps can be equalled by powerful tungsten units. Residence lighting is gradually being revolutionized through the introduction of tungsten lamps in this rather conservative field.

The newer arc lamps have also come in for improvement and more general use. This is notably true of flaming-carbon and metallic-flame lamps. The long-burning lamp of the former class has been so far perfected, particularly in the alternating-current series type, that it is now doubtless the lamp best adapted for the illumination of important business streets and those having very dense traffic. The length of the electrode trim has been increased whereas the electrodes themselves have been shortened and greatly cheapened. White-flame-producing chemicals are more generally employed for impregnation and produce a more pleasing result at an efficiency but slightly below that of the yellow-flame electrodes. Vertical electrodes are generally replacing the converging type with much better light distribution for most purposes. Further improvements toward the reduction in cost of electrodes and greater steadiness of the light are being worked out at the present time and bid fair to give this lamp still greater vogue than it has achieved already. The high efficiency of this alternating-current series lamp, together with the fact that it requires only simple lighting-substation equipment, has won its adoption for a very large part of the street lighting in Chicago; New York City is considering their employment on a large scale and other cities have already begun to use them for the illumination of their most important thoroughfares.

Magnetite or metallic-flame arc lamps continue to be used satisfactorily for the lighting of less important business streets in many larger cities and for practically all the street lighting of numerous communities whose appropriations or traffic do not warrant the change to the more efficient flaming arcs. The inverted magnetite arcs, more generally known as ornamental luminous arc lamps, have made

great headway for "White Way" lighting in several cities. They give a brilliant white and yet very unique and pleasing illumination and are very economical in performance. In the opinion of many authorities these lamps are worthy rivals of tungsten incandescent clusters for ornamental street lighting and bid fair to supersede them in many cases. The number of designs of ornamental standards for magnetite arcs is increasing and it is pleasing to note that they are in general of very graceful form.

A notable development of the year in electric illuminants was the commercial introduction into this country of the quartz-tube mercury-vapor lamp. The retarding of this development several years beyond the similar stage in Europe was unfortunate and yet it has given us a better form of lamp than is used abroad. Although these lamps have received but limited use as yet, they give every promise of being keen rivals of the flaming arc lamp for intense exterior illumination and for lighting large and high interiors. The lamps are of very high efficiency and operate at low maintenance cost. Their light is deficient in color value, but very penetrating and productive of high acuity of vision. An installation of a small number of these lamps for lighting a street in Chicago has produced the unique and exemplary result of lighting uniformly not only the street and sidewalk surface but also much of the building fronts, thus showing the possibilities resulting from mounting powerful street lamps high. Work is now going on looking toward the use of cadmium amalgam for quartz lamps, which gives promise of still further improvement of their efficiency and color.

Little need be said of the older forms of arc lamps. Their doom was sealed several years ago with the advent of high-efficiency incandescent and arc lamps. Aside from the modern intensive white-light pure-carbon arcs, all the older open and inclosed arc lamps are being rapidly retired.

In the line of lighting accessories, such as reflectors, shades, bowls, etc., relatively little development has taken place in the way of new materials, but many new designs have been produced both for utilitarian and artistic purposes. For the former these have been principally in enameled-steel and mirrored-glass reflectors; for the latter a multitude of new designs in opal and the decorative glasses have been brought forth. In fixtures also there has been active production of countless new designs, an increasing number of which happily embody not only great artistic beauty but a true appreciation of the canons of good illumination. The result is a great enrichment of the materials available to the illuminating engineer, and that he is making good use of them is to be seen in the fruits of his work.

Considering the year's progress in illuminating engineering decided advance is to be recorded, not in the development of new principles but in the much more general application of the fundamental principles whose truth has become unquestioned. Doubtless the most striking manifestation of this tendency is in the now quite common efforts made to eliminate glare by removing light-sources from the customary range of vision or else by partly or entirely inclosing them in diffusing glassware. A strong movement was put under way to compel the raising to a reasonable height of powerful lamps, such as flaming arcs. Exposed store-window lights are gradually becoming more scarce since the greatly enhanced illumination effect brought about by their removal is better understood. But in interior lighting do we find the best illustration of the tendency to avoid glare. Opal diffusing shades are now very common. Totally indirect lighting has steadily broadened its field. During the past year semi-indirect lighting has made much headway; its adaptability to artistic treatment, its warm and cheerful lighting effect and its practically complete elimination of all injurious visual strain are combining to give it merited popular recognition.

Looking back upon the brief history of this movement a most interesting development is disclosed. Ten years ago it was the common practice to use bare lamps or a small shade was occasionally used purely for decorative purposes. The second step was to use a shade of such shape as would more or less reflect the light without particularly screening the light-source itself. In the third step the bowl-type reflector was used which concealed the filament from the eye when a bowl-frosted lamp was employed. The fourth step has been the introduction of inclosing glassware, which has completely hid the lamp from the eye in the case of direct and semi-indirect lighting, and of opaque reflectors in the case of totally indirect lighting. The fifth step is now upon us and it is the general appreciation of the fact that illumination can be, and should be, made of artistic value in most places.

However, the conception of illumination of many people has not progressed beyond the first of these steps. That this is but too true is reluctantly acknowledged by many illuminating engineers. Therefore to inaugurate a more active propaganda of its teachings the Illuminating Engineering Society appointed a committee to draw up an elementary primer on illumination. When this was published a few months ago it elicited most favorable comment on all sides, because it set forth in non-technical language, with many concrete illustrations, those principles of good illumination on which all authorities are in common accord. This publication, although only a small booklet, is a valuable contribution to the fundamental literature of the subect, and has been a noteworthy achievement by the Society among its many services for the advancement of the science and art of illuminating engineering.

Electric Railways.

All the conditions affecting electric railways in 1912 operated generally to restrain large expenditures of capital for new enterprises. Banking support did not favor the commitments of large amounts of money for development. Rate conditions and tendencies of regulation were not encouraging to capitalists who furnish money for new enterprises, to the holders of existing securities who had seen prices depreciate, or to the managers of properties, who felt uncertain about the effect of these conditions and the state of general business on the railways in their charge.

Notwithstanding these influences, however, there has been general progress in electric railway conditions throughout the year. Existing lines have been extended, equipment improved and a fair gain has been made in gross earnings.

In the field of main-line electrification several important steps have been taken. The most important is the decision of the New York, New Haven & Hartford Railroad to electrify its main line from Stamford, Conn., to New Haven and from Boston to Providence, R. I., using the single-phase system therefor.

The special development in connection with the New Haven electrification and extensions is the change in transmission voltage and in the general system of transmission to be employed to effect complete compensation of electromagnetic induction on foreign wires, the need for which has been brought about by the large extensions of its electrified system and the inclusion of all passenger, freight and switching loads within a growing radius of distribution. This change consists briefly in the employment of a 22,000-volt three-wire system, of which the trolley wires form one side, the feeders the other; and the rails take the place of the ordinary neutral. Outdoor-type feeder auto-transformers with a 2 to 1 ratio are located every few miles. The result is a beautifully simple and effective system, wherein the potential stresses to ground remain as before—11,000 volts; but the transmission voltage has been doubled, and therefore the effective range of operation theoretically quadrupled. This change makes a new step forward, and is the most important electrification development in the railway world during the past year.

Especially gratifying has been the action of the directors of the New Haven

road in authorizing certain very large extensions to the single-phase system, and the following table is significant:

	1912.	1913.
Miles of single track....	114	552
Capacity of power house, horsepower	21,000	46,000
Number of locomotives..	41	151
Locomotives, horsepower	41,000	128,800
Locomotive mileage.....1,569,648		5,489,856

Other important main-line electrifications definitely decided upon are that of the Denver & Rio Grande from Pueblo, Colo., to Salt Lake City and the Pennsylvania Railroad between Philadelphia, Pa., and Washington, D. C. In connection with the latter project it is stated that power will be obtained from a new plant to be erected at Conowingo, on the Susquehanna River. Sites for the transforming and switching stations have already been acquired. Extensions of minor importance but all indicating decided progress, have been made on several other trunk-line railroads.

In the field of interurban and suburban traffic the most important event is the opening of the New York, Westchester & Boston Railway, which marks the completion of a heavy electric traction system which takes a place as the most important single-phase suburban railway in the United States equipped for high-speed service with multiple-unit cars. The application of high-tension single-phase current for multiple-unit train service is significant as showing how rapidly the design of single-phase car equipment has advanced during the past five years.

Another event of more than passing interest during 1912 was the re-equipment of the Fort Dodge, Des Moines & Southern Railroad for 1,200-volt direct-current operation. The business of this road, both passenger and freight, increased to such an extent that some means had to be adopted to increase the traffic-handling facilities. It is a significant fact that this could be, and has been accomplished by a change from 600-volt to 1,200-volt operation, and it is of great importance to note that these changes have involved but a small capital outlay.

Subway transit has received great impetus during the year just closed. In New York, in spite of obstacles and tedious negotiations, great additions are being made to subway facilities. In connection with this improvement there will be an extension of elevated-railway facilities. In Chicago another subway program has been outlined by a municipal subway commission. Preliminary negotiations are under way for a virtual consolidation of all the surface and elevated traction companies. This should co-ordinate future development along one broad general plan under which the existing properties will be of the greatest possible use in the transit scheme of the city. In Detroit an agreement is under consideration which will provide for the construction of a certain amount of new track during each year of the proposed new franchise contract. In substantially all cities there are different plans for development which are dependent in some cases upon agreement with the city upon terms and in other cases upon sufficient improvement in conditions to justify the purchase of securities by bankers.

In reviewing events transpiring in the street-railway field during the past year there is little that can be termed startling either in the development of new practice or in the lines of car equipment or operation. During the past year there has grown a keener interest in the standardization, purchase and specifications of apparatus. This desirable situation is a credit to the good work done by the committees of the American Electric Railway Association, the meeting of which held in Chicago in October was one of the important events of the year. Decided progress has been made during 1912 in car construction, the notable features being the improvement in lighting, heating and ventilating facilities. As to seating conditions, the new center-entrance cars which have been successfully introduced in New York, St. Louis, Pittsburgh, Brooklyn, Washington and other places have facilitated greater speed and comfort in street-railway transportation. Double-decked cars introduced in New York and Pittsburgh are also significant of the year's progress.

In connection with the transportation conditions of cities it is appropriate to call attention to the able and comprehensive paper presented before the monthly meeting of the American Institute of Electrical Engineers in April, by Samuel Insull, president of the Commonwealth Edison Company, Chicago, on the subject of the relation of central-station generation to railway electrification. The author presented data to show the advantage of centralized power supply with particular reference to the conditions existing in Chicago.

One of the significant features that have marked the history of electric railways for 1912 has been the tendency on the part of operating companies to use every means in their power to prevent accidents to the public and employees. In some of the larger cities vast amounts of money have been spent for general educational campaigns, and rules and regulations for employees of railroads have been made more stringent. In this connection mention should be made of the marked increase in the use of electric block signals on interurban and trunk lines during the year. The total mileage so equipped increased over 100 per cent.

Electrochemistry and Batteries.

Storage-battery developments during the year have been principally along commercial lines. There have been no radical changes in the design or construction of battery plates. There have, however, been put on the market a number of refinements in battery construction and in battery practice, resulting in improved service. The demand for batteries during the year has been large, the increase being occasioned principally by electric vehicles, the output of which is very rapidly increasing. Electric propulsion of ambulances and hearses is increasing in favor, and it is probable that ultimately electric vehicles will be used exclusively for this work.

The year has seen a very material increase in the use of electric vehicles, both of the pleasure and commercial types. This has been due in large measure to the activity of the Electric Vehicle Association of America. This organization has brought about a greater degree of co-operation between the manufacturer of electric vehicles and the central-station interests. Special rates for the charging of storage batteries and maintenance of garaging facilities have greatly increased the popularity of the electric. The splendid educational campaign carried on through the association's advertising in the technical, trade and popular journals and magazines has made prospective users of this equipment in all parts of the country familiar with its economies and many practical advantages.

The storage-battery car has been making a field for itself, and the past year has seen the production of a three-car train operated by Edison batteries from one platform by a special form of multiple-unit control. This was built for the United Railways of Havana, Cuba. Another type of car was a 50-foot combination passenger, baggage and smoking car built for the Chicago Great Western Railroad.

With respect to primary batteries, a contribution to the testing of dry cells has been furnished by the preliminary report of the committee of the American Electrochemical Society. Progress seems to have been made toward the much-needed standardization of

methods of testing dry cells, but much investigation remains to be done before a procedure can be adopted which will be satisfactory for all purposes for which such cells are used.

The field of the electric furnace is being continually broadened. Developments have been made both in types of furnace and in the applications made. One promising development in this country is the Hering furnace, which was brought out in 1911, but which has now been developed into a practical furnace. Its characteristics are simplicity and economy of energy. The Helfenstein furnace has met with continued success in Europe, especially for the manufacture of calcium carbide and ferro-silicon. One furnace for this purpose, having a capacity of 10,000 horsepower, has been placed in operation in France. This furnace has been found to have additional advantages when operated air tight, and it has been applied to iron-ore reduction and steel refining. A furnace consuming 24,000 horsepower, with a capacity of 250 tons, has been in operation at Falun for making pig iron. Experiments in iron-ore reduction have been continued at Trollhättan, Sweden, and while the results have been satisfactory, they are not yet entirely satisfying. Quality seems to be subject to greater variation than in a carefully worked ordinary blast furnace. The production of pig iron, or more properly, pig steel, in the electric furnace has, however, been demonstrated to be a commercial success, and several Swedish iron works are adopting this process. A much less quantity of charcoal is necessary in this process than in the blast furnace, and the product contains much less percentage of impurities and is, consequently, much better adapted for steel making. By its use the output of open-hearth steel furnaces can be increased 50 per cent. It has been found possible to produce this pig steel at the rate of four tons per horsepower-year.

The furnace for smelting iron ore at Heroult, Cal., has at last been put in successful operation, turning out about 20 tons per day. The practice here is different from that at Trollhättan in that there is no circulation of air in the furnace. Pig iron can be produced at a cost of about $14 per ton. This pig iron is found to be entirely free of manganese, sulphur and phosphorus and to be high in silicon. The carbon is all in the graphitic form so desirable in iron.

The electric steel furnace is steadily extending its influence. In foundry practice it has become a sharp competitor of the crucible and small converter. The best quality of castings can be made in soft, flexible steel. Rails of electric steel are being tried out both in this country and in Europe and are giving good results. Their production will probably soon reach a commercial basis. In Germany such rails have been in operation for four years and have been found to be unbreakable. Experience for two years in this country is similar, with 5,600 tons of rails in service.

The fixation of atmospheric nitrogen and the production of fertilizer continues unabated, especially in Norway, the product of whose furnaces can be shipped around Cape Horn to California in competition with the Chili saltpeter. The Norwegian saltpeter, or calcium nitrate, is made by the Birkeland-Eyde process. The Badische Company fixes the nitrogen as ammonia. At Trollhättan, Dr. Palmaer's process for bicalcic-phosphate fertilizers, with the aid of electrically produced acid and alkali, is in commercial operation.

Electrical Machinery.

The developments in electrical machinery in 1912 were chiefly along the line of further adaptation of improved principles in design that had already been introduced. The improvements to various classes of machinery resulting from their redesign to incorporate the most modern ideas were of considerable moment; added to these were many improved methods of manufacture, all these together producing more rugged and serviceable machines. As usual there were numerous increases in sizes, some of which involved new methods of construction to accommodate them. Although the year has produced no startling innovations, neither has stagnation been the rule, in fact substantial progress has resulted not only on the lines indicated above but in great extensions of the use of electrical machinery, particularly motors and outdoor transformers.

In generator practice probably the most noteworthy achievement is the order to build a turbo unit of 25,000-kilowatt maximum rating, work on which is now under way. This machine will be driven by a horizontal Parsons steam turbine and will go into the extension of the Fisk Street station of the Commonwealth Edison Company in Chicago. Although this complete unit is being constructed abroad, its early installation in this country is of deep interest to us. It will be the most powerful combined prime mover and generating unit ever built. The generator will develop 4,500 volts and to it will be connected a step-up transformer raising the potential to that of the 9,000-volt busbars and incidentally providing the power-limiting reactance.

Several other horizontal machines of 15,000 and 20,000 kilowatts rating and for speeds of 1,800 and 1,500 revolutions per minute are under construction. A number of 20,000-kilowatt vertical machines were put in operation. The past few years have seen an extraordinary increase in the available output of turbogenerators. Within three years the ratings have nearly doubled. This increase is due to a number of causes, among which are the developments in the design and construction of steam turbines, the more general use of mica and asbestos as insulating materials, better methods of cooling compact powerful machines, improvements in details of design and construction methods resulting from accumulated experience. Still further increases in size have been predicted.

The size of water-wheel-driven generators has also increased and several ranging from 12,000 to 17,500 kilovolt-amperes are under construction. A notable development in this line is the construction of a number of very low-speed vertical generators for direct coupling to low-head hydraulic turbines. A group of 5,000-kilowatt, 250-volt, direct-current machines for an aluminum works are being built.

Many improvements aside from increased output have also been made to other classes of generators, particularly the use of commutating poles for direct-current machines. A further advance in high-frequency alternators for wireless telegraphy has produced an inductor-type machine capable of operating at 200,000 cycles per second.

Synchronous converters are now being quite commonly built with commutating poles and operated at higher speeds than formerly. The 60-cycle machines have now been proven as reliable and satisfactory as the older 25-cycle units and for 60-cycle rectification are to be preferred to the more expensive and less efficient motor-generator sets. Converters for 600-volt direct-current railway service have been built in sizes up to 7,500 kilowatts and in bulk are not much larger than older machines of only one-fifth the rating.

In motors, a significant development is the much more general use of synchronous machines for raising the power-factor of a transmission system or distributing network. This use of these motors as synchronous condensers has proved effective in increasing the capacity of lines heavily loaded with induction motors. Coincident with this use the motors are often called upon to develop more or less mechanical power. Synchronous motors have been very successfully adapted to driving air compressors and quite a few plants of this kind are operating with complete satisfaction. For many purposes a synchronous motor that is not self-starting cannot

be used; the further development of the self-starting motor has therefore proven an important achievement.

The new unity-power-factor motor is the most important development in single-phase induction motors. Central stations have been reluctant to employ the latter extensively because of the large "wattless" load they impose on a system. The new motors therefore serve to increase very decidedly the amount of power load that can be satisfactorily carried on single-phase feeders.

Much study has been given to the development of polyphase induction motors of the adjustable-speed type that would have a greater economical speed range than is possible with the secondary-resistance and cascade-concatenated types. This has usually involved the use of commutator motors in which the complicated problem of successful commutation has not yet been satisfactorily solved. Consequently such motors have not yet come into use in this country on a commercial scale.

Where speed changes are required the multi-speed polyphase induction motor with adjustable rotor resistance continues to give sufficiently satisfactory service to warrant its increasing use for a variety of purposes. At the same time squirrel-cage motors are rapidly proving more popular, where they can be used, because of their very rugged construction that makes them particularly suitable for the most severe service and where inflammable materials abound.

Direct-current motors intended for adjustable-speed service are now very commonly provided with interpoles as they permit of very wide speed range without troublesome commutation. The field of application of these commutating-pole motors has been very much extended and they are now to be found quite commonly in mill, machine shop and railway service; for the latter purpose they are particularly suited to service on 1,200 and 1,500-volt lines, where their use is indispensable. The commutating-pole motor has permitted the development of completely successful reversing motor drive for planers, shapers, slotters, etc.

In the class of small motors there has been an extraordinary increase in their use. This is partly due to improvements in manufacture, such as pressed-steel casings, that produced a material decrease in weight and also a decrease in cost of production. An alternating-current split-phase motor that gives a relatively high starting torque without the complication of a clutch has been produced and has the further advantages of reduced weight and cost.

Mention must be made of the most significant development in transformers, which is the rapidly growing use of the outdoor type for even the highest transmission potentials. The successful equipment of outdoor substations permits the provision of service to many localities whose relatively small load prohibits heavy expenditures for substation buildings. Likewise the satisfactory performance of pole-type transformers for voltages even up to 33,000 permits serving many farms, ranches, irrigation pumps, etc., that will add materially to the load density of extensive rural transmission and distributing lines. Practically all the manufacturers of transformers have added outdoor transformers to their line of products. In their construction, of course, particular care has been given to the matter of insulation. In general, these transformers are built along the lines developed in 1911. Some of the large outdoor-substation units have been provided with water cooling. Along with the development of these transformers has been corresponding development of outdoor air-break switches, oil circuit-breakers, lightning arresters, etc., all of which giev promise of completely meeting the most severe technical requirements of lines in sparsely settled districts.

Electrical Construction and Inspection.

The year 1912 was unquestionably one of unusual progress in the field of electrical contracting. The annual convention of the National Electrical Contractors' Association, at Denver, last July was of itself sufficient evidence of the correctness of this assertion, this having generally been conceded to be the best meeting the national organization of contractors has ever held. The presence there of contractors from nearly every section of the country was a sure sign that the influence of the Association and the enthusiasm of its leaders are really becoming national in their scope; the attendance in large numbers of representatives of other branches of the electrical industry was a reliable indication of the growing recognition of the importance and the dignity of the contracting business.

In this connection the work of state and local associations of contractors during the year should also be mentioned, for the place of these is one which even the National Association cannot fill—or, to put the matter more concisely, the efforts of the national organization must lose much of their effectiveness if there cannot be co-operation with local and state associations for the purpose of carrying out the policies of the national body. Moreover, in almost every community where electrical contractors work problems have to be dealt with which can be handled through the local organization better than in any other way. At present some 50 of the larger towns, scattered over nearly half as many different states, have their own branch associations of contractors, while cities like Chicago and New York have more than one association. Most of these are holding meetings weekly for the practical consideration of problems which arise in the course of the week's work.

State associations have been unusually busy working along definite lines of improvement. For example, in one state a state-wide campaign for the better education of the contractor in methods of business accounting has been originated and is now under way. Realizing that one of the most unfortunate conditions in the electrical contracting business is the fact that many contractors employ no means at all adequate for keeping reliable information on the cost of jobs they do, members of the state association proposed to that body that funds be provided and a committee appointed to find or develop a system of accounting really adapted to the needs of the contractor, and to put this within easy reach of men who might care to use it. After a thorough canvass a system was adopted, which the committee is now engaged in bringing to the attention of contractors throughout the state.

The piece of work just referred to is mentioned for the special reason that it seems to have been characteristic of activities of electrical contractors' associations in general throughout the year. There has been a general tendency to get away from the procedure of allowing movements to end with discussions of what might be accomplished or what it is desirable to accomplish; the disposition toward definite, energetic action has been constantly growing.

In the matter of improvement in methods of electrical construction the year 1912 was one of good progress. Perhaps the most significant improvement in construction materials was the general adoption of a better grade of rubber-covered wire for interior circuits. New specifications for this class of material were incorporated in the 1911 edition of National Electrical Code, it will be recalled; but it was necessary, of course, to allow manufacturers time to provide supplies of the new product and to give contractors and other dealers a reasonable time to dispose of quantities of the old wire already on hand. Changing over to the better grade of wire began early in the year, but in most places the use of old-Code wire in certain of the larger sizes and in fixture wires was permitted until along in the summer. Present reports indicate that the use of the new-Code wire has now become general, and there is nothing to lead one to suppose that the change over from the old wire to the new was nearly so inconvenient a procedure as many contractors

and supply men had feared that it would be. This adoption of wire having a better grade of insulation, and the new system of inspection put into operation by the wire-inspection service during the year should mean a great deal to the electrical industry; for, after all, the safe life of an installation of interior circuits depends in a very large measure upon the sort of insulating covering the conductors have.

Developments in electrical fittings during the year were along satisfactory lines, and the growth of the practice of using standard, high-class fittings in place of cheaper makeshifts even in wiring of a somewhat temporary nature has been fortunate.

In conclusion, the spread of conduit construction and the formation of municipal departments of electrical inspection should be referred to. In the South and West especially there seem to have been unusual advances.

Instruments, Measurements and Theory.

Measurement of voltage in high-potential insulation tests by means of properly dimensioned spheres instead of needle points has found favor. The increasing importance of insulation has led to considerable activity in development demanding commercial forms of apparatus for measuring permitivity (specific inductive capacity). Hot-wire instruments are again coming into more general favor, especially where other types are not well adaptable. Oscillographs have received increased application in a variety of work previously attempted only in physical research. The determination of internal temperatures of machines, etc., by resistance thermometers and thermocouples has found increased favor. Small instruments for automobile use and similar applications, built along the line of larger precision instruments, have found considerable demand. The employment of ammeters with windings directly inserted in high-tension circuits where possible, or in connection with inexpensive transformers of approximate accuracy, which are constructed as part of the oil switch and make use of the switch insulation, has become more common. There is a general tendency to avoid expensive equipment for measuring directly on high-tension lines in favor of meters on the low-tension side.

Watt-hour meters have found increasing favor in small and less expensive designs. Good accuracy has been retained, making it possible to extend the lower limit of profitable supply by central stations to small consumers. The constancy of induction watt-hour meters as affected by transportation has been investigated at the British National Physical Laboratory. The observed changes in the rate of meters were found to be small and erratic. The Bureau of Standards at Washington has been carrying on during the year a thorough test of American direct-current watt-hour meters. The test of large direct-current watt-hour meters has always been difficult and portable test meters are not applicable to this work. The method brought out during the year by Ingalls and Cowles uses a special arrangement of manganin shunts and a galvanometer by means of which a test meter may be made to carry a small and definite portion of the main current. This method is especially advantageous for fluctuating loads. The use of meters on street-railway cars has grown in favor.

The Agnew electrodynamometer is probably the most unique indicating electrical instrument of the year. It carries 5,000 amperes in its series "coil," which is made of solid concentric copper tubes. Stranding of the fixed coil has been the expedient formerly used to avoid errors on alternating current due to change of distribution of the current. In the Agnew instrument the form of the coils gives the same torque for a given current for any radially symmetrical distribution.

The atomic character of electricity, which had already been demonstrated, has been placed upon a sure foundation by the later experiments of Millikan, whose final determination of the value of the elementary quantity of electricity has given the result 4.774×10^{-10} C. G. S. electrostatic units. This is believed to be correct to 0.2 per cent.

General Survey.

A conspicuous feature attending the general development of the industry has been the appreciation of the enhanced value of public-utility securities. The notable convention of the National Electric Light Association at Seattle, Washington, in June, focused the attention of the financial world upon the extent to which the industry had grown and the remarkable way in which it served all habitable places. The commingling of the leaders in the industry from all sections of the country resulted in a material broadening of influence and a better understanding of the enormous possibilities still undeveloped. The convention of the American Electric Railway Association at Chicago in October, attracted widespread attention, and the participation of important financial interests in the proceedings added greatly to the knowledge of the investing public of the stability of these public-utility enterprises.

The great activity in building construction and rehabilitation of every description has brought about a big improvement in the wire and conduit business.

There has been a notable absence of federal activity with regard to electrical manufacturing enterprises. During the year the licensed manufacturers of incandescent lamps, working in conformity with the decree handed down by the Department of Justice, have adjusted their organizations to meet the new situation. The various companies are now operated as constituent works of the General Electric Company, maintaining the individual trademarks and brand names and keeping undisturbed the personnel which had contributed so materially to the development of this business. This method of procedure has worked out very successfully and the incandescent lamp industry has progressed as a commercial unit to a remarkable extent, the value of the product having been enhanced, it is understood, several million dollars.

In underground cable construction proportionately more cables insulated with varnished cloth have been used this year than ever before. There seems to be a large demand for this kind of material. There has also been a heavy demand for paper-insulated cable and rubber-insulated cable, and there has been a tendency toward the use of cables for somewhat higher voltages, with considerable inquiry with regard to the electrical and mechanical characteristics of these cables. The year has been a very active one for the cable manufacturers, although the profits have been small. Paper-insulated cables have been used to a very great extent for parking systems in connection with underground distribution of energy to ornamental post lighting. These have also had extended vogue for emergency installations and for street-lighting improvements where the extent of the installation and the lack of need for a more flexible system did not warrant the use of extensive trench construction and clay conduit.

The table which follows gives an estimate of the value of electrical and some of the auxiliary manufactures of

the United States. This table has been compiled from data submitted by the leading manufacturers of the country. It will be seen that in many products there has been a very material increase over last year.

ARTICLES.	For the Year				
	1908	1909	1910	1911	1912
Arc lamps and appurtenances	$ 2,000,000	$ 2,500,000	$ 2,750,000	$ 3,000,000	$ 3,000,000
Auxiliaries, steam, for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc	2,000,000	3,000,000	3,350,000	3,000,000	3,500,000
Bells, buzzers, push-buttons, call-boxes, annunciators	1,300,000	1,500,000	2,000,000	2,000,000	2,000,000
Boilers for electrical plants (water-tube)	4,000,000	5,000,000	5,500,000	4,800,000	5,000,000
Boilers for electrical plants (other than water-tube)	1,500,000	1,750,000	2,500,000	3,000,000	3,500,000
Cables, underground, aerial and submarine	10,000,000	11,000,000	12,500,000	13,000,000	16,000,000
Carbons for lamps, batteries, brushes or other electrical purposes	2,250,000	4,000,000	4,500,000	5,000,000	5,500,000
Circuit-breakers	920,000	1,200,000	1,350,000	2,000,000	2,500,000
Conduits (underground) and similar material	500,000	700,000	850,000	750,000	1,500,000
Dynamos and motors, including parts of machines, boosters, balancers, rotary converters, motor-generators, etc., and all motor applications, such as in automobiles, not specifically enumerated in this list	50,000,000	70,000,000	75,000,000	80,000,000	100,000,000
Electroplating and other electrolytic apparatus not elsewhere specified	1,000,000	1,100,000	1,000,000	1,000,000	1,200,000
Electrostatic machines, induction coils, medical sets, etc	500,000	600,000	750,000	700,000	800,000
Elevators, electric (mechanism only)	1,600,000	2,000,000	2,600,000	2,500,000	3,500,000
Engines, gas or gasoline or oil, used to drive eletrical machinery	6,000,000	9,000,000	9,000,000	12,000,000	14,000,000
Engines, steam (reciprocating), used to drive electrical machinery	9,000,000	12,000,000	12,000,000	10,000,000	11,000,000
Fans, electrically operated and direct-connected	1,100,000	1,500,000	2,000,000	2,250,000	2,000,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc	900,000	1,000,000	800,000	900,000	1,000,000
Fixtures for electric lighting	8,000,000	10,000,000	11,000,000	12,500,000	20,000,000
Fuses	750,000	1,000,000	1,150,000	1,500,000	1,000,000
Glassware, electrical	2,000,000	2,500,000	3,000,000	3,500,000	6,000,000
Heating and cooking apparatus, electrical	1,000,000	1,500,000	2,000,000	2,500,000	4,000,000
Incandescent lamps (carbon or metal filaments)	11,000,000	14,000,000	17,500,000	19,000,000	22,000,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc	2,000,000	2,250,000	2,400,000	2,400,000	7,000,000
Insulating material, fiber, tape, etc	1,700,000	2,500,000	2,700,000	3,000,000	5,000,000
Insulators (glass and porcelain)	1,350,000	2,300,000	2,560,000	2,500,000	3,500,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc	2,220,000	3,000,000	2,500,000	4,000,000	5,500,000
Lightning arresters	275,000	400,000	500,000	500,000	600,000
Mercury-vapor lamps	300,000	500,000	700,000	800,000	900,000
Poles and wire towers, cross-arms, brackets and pins	3,500,000	4,000,000	5,000,000	5,500,000	5,500,000
Primary batteries	1,000,000	2,000,000	2,500,000	2,700,000	3,000,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc	2,200,000	3,000,000	3,250,000	5,000,000	7,200,000
Rheostats, car controller, motor starters, etc	2,600,000	4,700,000	5,000,000	5,000,000	6,000,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	400,000	500,000	500,000	750,000	1,200,000
Signs, electric	1,000,000	1,250,000	1,500,000	2,000,000	4,000,000
Sockets, switches, cut-outs	4,000,000	5,000,000	6,000,000	6,000,000	7,500,000
Steam turbines used to drive electrical machinery	7,000,000	12,000,000	14,000,000	10,000,000	14,000,000
Storage batteries, including those used in automobiles	5,500,000	6,600,000	6,750,000	10,000,000	12,000,000
Telegraph instruments and apparatus	400,000	600,000	500,000	600,000	650,000
Telephones, telephone switchboards and distinctively telephonic apparatus	15,000,000	15,000,000	20,000,000	20,000,000	16,000,000
Transformers, stationary	3,025,000	4,000,000	4,500,000	5,000,000	10,000,000
Water-wheels, used to drive electrical machinery	3,000,000	4,000,000	3,500,000	3,000,000	5,000,000
Welding apparatus, electric	.....	150,000	200,000	200,000	400,000
Wire, bare	18,000,000	22,000,000	24,000,000	25,000,000	33,000,000
Wire, rubber-covered	11,000,000	12,000,000	15,000,000	15,000,000	18,000,000
Wire, weatherproof	9,000,000	10,000,000	12,000,000	13,000,000	15,000,000
Wire, all other electrical	4,000,000	5,000,000	5,000,000	5,000,000	7,000,000
Wireless apparatus	500,000	500,000	350,000	400,000	500,000

Electrical Affairs in Great Britain in 1912.

By Albert H. Bridge.

Notwithstanding the unparalleled labor wars which affected nearly every department of industry in the United Kingdom at some time or other during 1912, the year has been one of the busiest on record. The general trade of the country has been in a flourishing condition and the electrical engineering industry has been sharing in the prosperity. The waning of the year is not without its reminders of industrial unrest, but the outlook, electrically, is perhaps brighter than it has ever been before. The strikes which held up manufacturing for a time had as an immediate consequence a rush for electric drive. The motor was allowed a chance to prove its ability before unbelievers, because steam engines were idle for lack of coal, and won its way into a permanent place in new industrial works of all classes. This and other circumstances, including the boosting of domestic electric supply business, have brought such a demand upon central stations that everywhere they have been ordering new generating equipment —chiefly steam-turbine sets or internal-combustion engine sets. Another important factor in the situation is the general development that is taking place throughout the world; this has had a healthy effect upon the electrical and allied industries, and while so much of the world remains unprovided with electrical facilities it must continue to do so, while confidence lasts. British exports of electrical goods and apparatus, in addition to machinery and telegraph and telephone cable, amounted during the eleven months for which returns are available as I write to $20,250,000, which is an advance of $7,220,000 on the previous year. "Machinery" exports, which embrace certain electrical lines, increased by $10,500,000. It is reasonable to anticipate a still better year in 1913, for in addition to every other hopeful sign there is one for which we have waited long—railroad electrification. So laggard, it has at last actually come, and between 200 and 300 track miles in the neighborhood of London are now definitely settled upon and work will start directly. Then the big contracts for the electrical conversion of the Melbourne (Australia) suburban railroads have also been settled, and British factories will be busy with them.

Not only has there been improvement as to volume of business, but also as to the more important matter of price, so long a cause of complaint. The Electrical Manufacturers' Association in its reorganized form with an increased membership has been at work in various directions. The Institution of Electrical Engineers has settled down after its lengthy controversy and the membership is growing rapidly. A special Industrial Committee has just been appointed by the Institution. In the metal-filament-lamp section of the industry there has been much patent litigation and a more settled situation now prevails. A Tungsten Lamp Association has been formed, in which a number of the principal makers are

banded together for certain purposes. Two new large concerns have been floated during the year for the manufacture of Diesel engines in England, and their factories are now being erected. New cable manufactories also are going up, and one is to come at Southampton.

The Government took over the system of the National Telephone Company in January, 1912, and arbitration proceedings respecting the purchase price ($100,000,000 claim) are not yet finished. But the Post Office, as the new authority, has, as far as the staff available has permitted, entered upon the work of reorganizing and scrapping, and in this department of electrical activity there is many millions of dollars' worth of business coming. Several new exchanges have been brought into service, some of them equipped on the automatic system. In expectation of large demands for this system a special company has been established to manufacture the apparatus in the United Kingdom. There was, among the other events of the year, a demonstration before the Queen, by a private inventor, of the use of wireless telephony over short distances.

In the wireless telegraphy field the year has been crowded with incident. Advance has taken place in every direction. The understandings arrived at between Marconi-Lodge and Telefunken interests have tended to simplify the position and to facilitate advance. The British Government entered into an agreement with the Marconi interests for an Imperial scheme involving the construction of long-distance stations required for the first section of the comprehensive scheme embracing the whole of the British Empire. The British and Colonial Governments decided to proceed with the erection of stations at London, Egypt, Aden, Bangalore (India), Pretoria, and Singapore at $300,000 each, exclusive of the sites, foundations and buildings. The Marconi company will operate the stations on behalf of the Government for the first six months and will receive ten per cent of the gross receipts of all the long-distance stations for 28 years thereafter. This agreement—the event of the year in wireless—has lately been the subject of a prolonged and searching inquiry, owing to questions which arose in the press and in Parliament, and at the time of writing the proceedings are not finished and the confirmation of the agreement by Parliament awaits such conclusion and report. The inquiry, among other things, gave an opportunity for the American representative of the Poulsen system to show what has recently been done with that system in long-distance working.

There has been very little new street-railway work carried out. In several places short railless electric trolley systems have been brought into operation, including Dundee and Rotherham. Many such schemes are now in contemplation, applications having been filed with Parliament. Motor-omnibus traction has been the most troublesome factor to the electric-tramway man in 1912, and many tramway-owning authorities are seeking Parliamentary permission to run these as well as railless electric vehicles. The gas-electric omnibus has made good progress and promises well. In addition to a large number introduced on Tilling's London services, vehicles of this class have been ordered by Birmingham, Newcastle, Liverpool, Greenock and other cities. The chief additions to tramways have been those to the London County Council system, and so large has the demand grown for power for this purpose that the celebrated Greenwich generating station is to be re-organized by the substitution of 8,000-kilowatt turbine sets for each of four 3,500-kilowatt reciprocating-engine sets, increasing the capacity of the existing station from 34,000 to 52,000 kilowatts and causing such economies in the coal bill as to more than provide for interest on the new capital expenditure. Large turbines are being put into many power stations; 10,000-kilowatt capacities are not at all unusual, and at one of our turbine works turbogenerators of 25,000-kilowatt capacity are building for America.

In electric-railway work there has been much financial reorganization and amalgamation of London tube lines, which, together with understandings between tramway and omnibus authorities, may facilitate transit in the metropolitan area; the Central London electric line has completed its section from the Bank to Liverpool Street, making a valuable connection; the East London underground railway, after years of talking on the matter, has actually been electrified and will be running under the new conditions directly. The London, Brighton & South Coast Railway has carried its single-phase section farther and report says that the North Eastern company is going to equip part of its lines on the overhead system.

In the electric light and power department one might give a string of names of places where big schemes have been drawn up for large new, or extended power stations rendered imperatively necessary by the rapid increase in demand for practically all purposes—Glasgow, Leeds, Birmingham, Dublin, Belfast, Hackney and other parts of London, and so forth. The movement is fairly general. Coal bills have been higher for all electricity producers, owing to the coal strike, and they never will return to their former figures, but the matter of charges and commercial development of electricity selling generally, are being handled with greater enterprise, and the day load for cooking and heating and other domestic purposes is assuming larger proportions. There was no big electrical exhibition during 1912, but small ones and local cooking demonstrations, either by suppliers of electricity or by makers of apparatus, have been numerous and they always draw large and useful crowds. Heating and cooking has been popularized by the big electric restaurant that did such excellent service during the Earl's Court Exhibition in London, and another feature of the year was the opening of a large electric kitchen for providing workers' meals in Marylebone, of which this journal contained a description at the time. The movement in the direction of hiring out cooking apparatus, etc., is growing, and the tendency now is toward holding out every reasonable inducement to the householder to adopt electricity for all domestic service. The reader may remember the recent formation of the Point-Five Club (cent per unit) which seeks to secure new adherents to the policy of selling electricity at that low rate for cooking purposes.

Several new waste-heat power stations have got to work in the northeastern counties (Port Clarence, Ayrsome, and Redcar), and a new power-supply scheme for colliery service that should be named is the southeast Kent system for supplying the collieries that are being developed there. A beginning has been made with a 1,400-kilowatt turbine plant (three-phase at 3,000 volts and 50 cycles) for sinking and pumping and other preliminary operations. A demand for more than 30,000 kilowatts is anticipated in the future. As to colliery work in other parts of the country, the Lancashire Electric Power Company is supplying to collieries in its district about 40,000 horsepower, they taking about four million units per annum. It is estimated by a recognized authority that in the Newcastle district electrical energy is being supplied at the rate of 55 million units per annum for colliery purposes; in South Wales 16,000 horsepower is contracted for for the same purpose; in Clyde Valley 8,500 horsepower, and in Yorkshire 6,000 horsepower. In the big power stations in London and other places the supersession of antiquated and extravagant steam and electric plant continues.

Nothing happens to hinder the advance of electricity for street lighting, though where the claims of high-pressure gas have been strongly pressed against it, matters have been settled for a time by contracts being divided up between the rival illuminants. The municipal electrical authorities and the electrical contractors have not yet arrived at a settlement of their long-standing differences, but there is a good deal of sympathy with the rights of the contractor, if only he can prove his ability to meet the requirements of the situation, and it looks as though peace may soon come in the form of compromise.

Central-Station Ice-Making.

An ice-making plant as an adjunct to an electric central station, possesses features which enable the two plants to be run on a more economical basis than would be possible with either plant running singly. Reports presented in this article from numerous localities show that ice profits oftentimes exceed profits from the electric station.

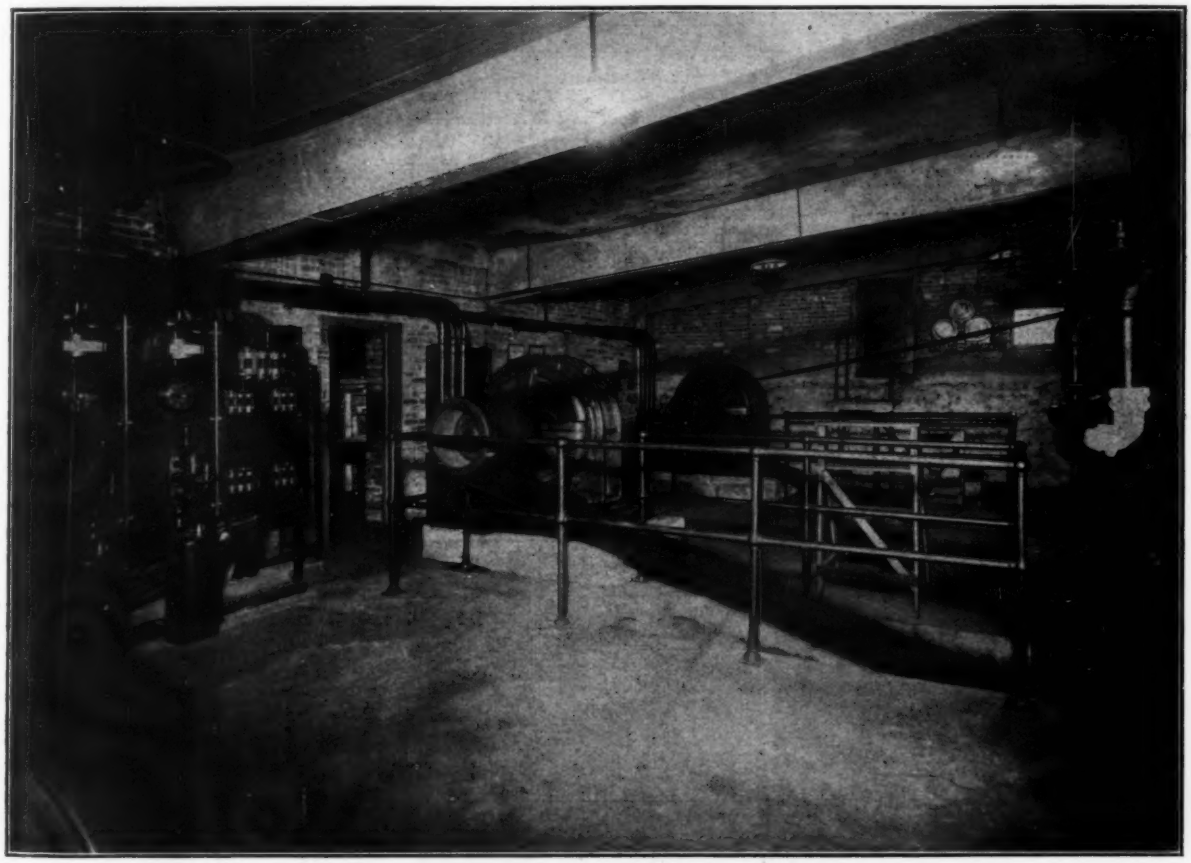
The most vital problem confronting central-station managers, particularly in small cities and towns, is the increase of income through the summer months and the utilization of all resources in order to realize the maximum revenue with minimum operating expense. The demand for continuous service, necessitating the operation of the plant both day and night, is becoming almost universal; and only in very small communities is day service cut out. The income from the day load, which in summer time is naturally very light, is comparatively small and hardly warrants the increased operating expense. The problem is to increase the income during these months and if this additional revenue can be had at very little additional cost, so much the better. Close competition and modern methods require the utilization of all by-products, and often the largest profits are in such use.

Ice-making as a side line for central stations is not a new idea but it is only within comparatively recent times that any prominence has been given to this subject. A little consideration will readily show that an ice-making plant, as an adjunct to a central station, possesses features which enable the two plants to be run on a more economical basis than would be possible with either plant running singly.

A single investment for real estate, buildings and steam power plant is all that is necessary for both departments. In many instances it is possible to house the ice-making plant under the same roof with the electrical department, and to utilize the services of the same engineers and firemen. By these means considerable reductions can be made in the operating expenses, and a greater margin of profit left, than would ever be possible with either plant running singly.

Ice-making is also an excellent means for utilizing the surplus power of the generating station, and for filling up the valley in the load curve during the off-peak periods.

As to natural ice, every winter is not a good ice winter and ice is expensive both to store and transport. Every summer is a good ice-making one for the artificial plant, however, and its storage charges are nominal. Also the artificial ice, while perhaps no better than the best natural ice, runs much more uniformly and is of considerably better grade. Moreover, with artificial ice the water can be distilled or sterilized before freezing so as to remove the dangers which have been found to exist in the natural product. These features, it will be seen, favor artificial ice, irrespective of cost, but it is also



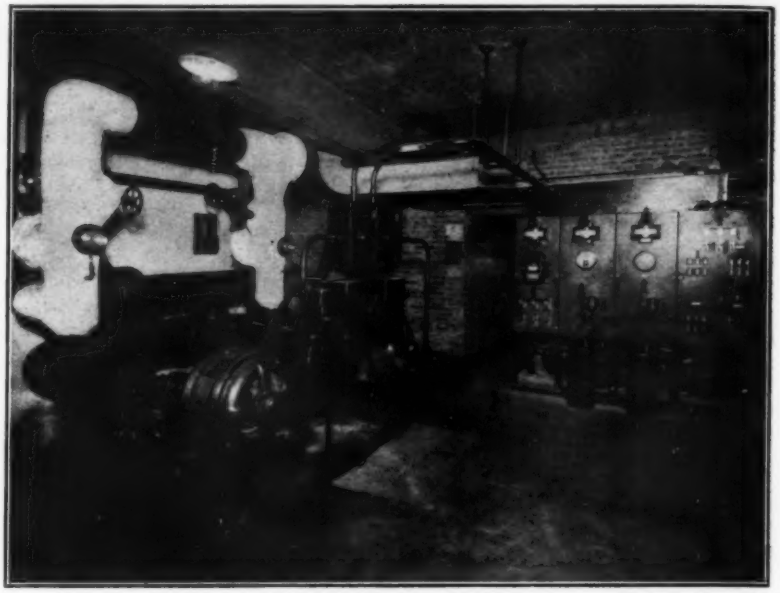
Motor-Driven Ammonia Compressors in Combination Ice-Electric Plant.

true that the average cost of manufactured ice, where cheap energy is available, is if anything rather less than the cost of the natural ice plus storage and distribution charges.

Artificial ice plants are not nearly so restricted in geographical distribution by climatic range or the competition of natural ice as is generally believed. It has been found that there are about 300 combination ice-electric plants at present in operation, and presumably operating at a good profit. The following table gives the plants operating in each state and shows that while the majority of combination plants are located in the southern states a surprisingly large number are located in Illinois, Kansas and other Middle West states, indicating that the cleaner, purer qualities of artificial ice need not fear competition from the natural product even in northern latitudes.

TABLE I. COMBINATION ICE-ELECTRIC PLANTS.

State	Number of Plants
Alabama	2
Arizona	1
Arkansas	12
California	2
Colorado	5
Florida	15
Georgia	5
Hawaii	1
Idaho	1
Illinois	16
Indiana	4
Iowa	5
Kansas	16
Kentucky	18
Louisiana	8
Maryland	2
Michigan	1
Minnesota	2
Mississippi	5
Missouri	17
Nebraska	3
New Jersey	2
New Mexico	4
New York	2
North Carolina	4
Ohio	4
Oklahoma	30
Oregon	1
Pennsylvania	2
South Carolina	4
South Dakota	1
Tennessee	9
Texas	86
Virginia	9
Washington	2
West Virginia	5
Wisconsin	2
Total	308



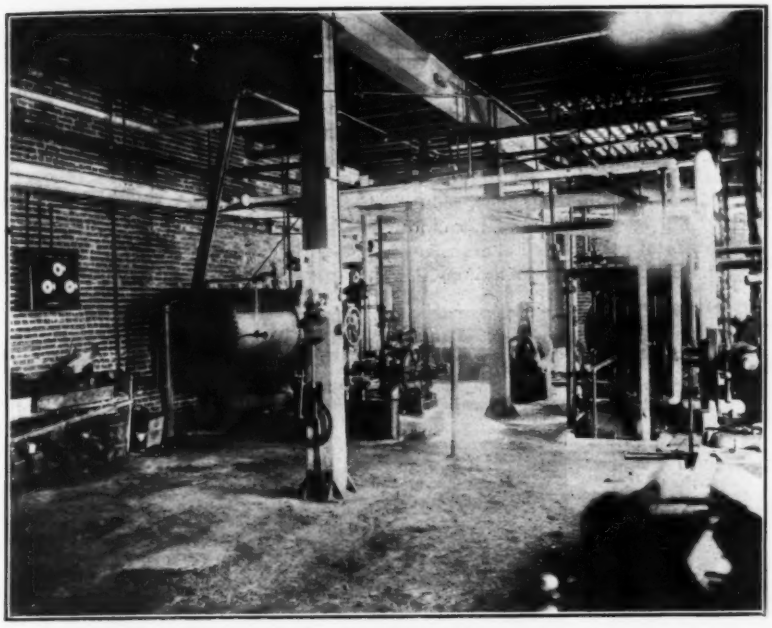
Motor-Driven Brine Pumps.

Ice-making and refrigerating plants can be classified under two distinct headings, (1) compression plants, in which the gas is drawn from the expansion side of the plant by the action of a compressor, then compressed to a liquefying pressure, and finally discharged into the condenser; and (2) absorption plants, in which the heat of the steam is used directly to expand the ammonia gas in the generator, producing in this way sufficient pressure to cause the gas to liquefy in the water-cooled condenser coils. Passing from these the ammonia liquor is then evaporated in the expansion coils, in contact with the brine or material to be chilled, taking up in the process heat which is delivered to the cooling water at the end of the cycle. The steam used to boil the ammonia gas can also be condensed and collected as distilled water.

With absorption plants, for every three engine horsepower, one ton of ice can be made daily. If the engine horsepower is estimated and divided by three, the number of tons of ice that can be made daily is found. In order to make use of the exhaust steam from engine it is necessary to have a good supply of cool water from a well or other source for condensing purposes and this water generally has to be pumped. Power must also be used for operating the ammonia pump, distilled-water pump and ice-tank agitators. The total amount of power for all auxiliaries ranges from one-half to three-fourths horsepower per ton of ice, depending upon the height the water has to be raised in the well.

In plants using steam turbines, or in large plants running condensing, or where the steam required to operate the machine is only a small percentage of the total steam used by the large electric unit which would make it unprofitable to use exhaust under back pressure as low as three pounds, it is perfectly feasible to use exhaust from the boiler-feed pumps or any other steam pumps about the plant, under the required back pressure. This exhaust would probably be sufficient to operate the ice machine. A plant using the exhaust from the pumps can also be

Freezing Tank, Hillsboro Electric Light & Power Company.



Absorption Ice Plant of Hillsboro Electric Light & Power Company.

installed where the condensing water is of a high temperature, as from rivers, lakes, or water-cooling towers.

In the compression system a motor-driven compressor is employed to produce the pressure at which the ammonia liquefies in the cooling coils. The remainder of the cycle is similar to the absorption process. With such a compressor motor load situated either in the station itself or controlled directly therefrom, extremely favorable conditions for improving the plant load-factor are established for the compressor runs long hours daily and can be slowed down or stopped during the time of the electric peak.

It is somewhat difficult to accurately estimate the kilowatt-hours required to produce a ton of ice. This figure will naturally vary in different stations, local conditions being largely responsible for the variations. Investigations which have been made, however, fix this figure at somewhere between 50 and 60 kilowatt-hours for plants working on the compression system.

The power required to drive an ice-making plant will vary from 2.8 to three horsepower per ton of ice in the larger plants, to four horsepower per ton of ice in the smaller plants.

The horsepower required to drive an ammonia compressor when the back pressure and condensing pressures are known can be determined by aid of Table II.

TABLE II. MEAN EFFECTIVE PRESSURE.

Back Pressure.	Condenser Pressure. 150	160	170	180	190	200
5	51	52	54	56	58	60
10	56	58	60	62	64	66
15	62	64	66	68	70	72
20	65	67	69	72	74	76
25	67	69	72	76	78	80
30	68	71	74	78	80	83
40	69	73	76	80	82	86

It is necessary to multiply the area of the piston in inches by the mean effective pressure found in above table; then multiply by the speed of the piston in feet per minute and divide by 33,000. This gives the horsepower required.

To this result, twenty per cent should be added to take care of friction losses in the machines.

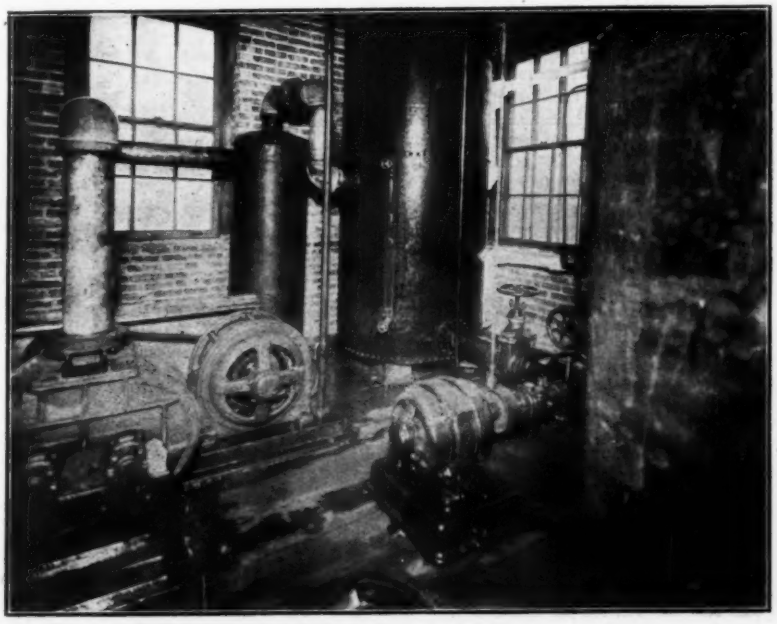
For example, the horsepower required to drive an ammonia compressor having a double-acting compression cylinder 10 inches in diameter by 18 inches stroke, running at 80 revolutions per minute, with 20 pounds back pressure and 180 pounds condensing pressure would be as follows:

Area of cylinder 10-inch diameter= 78.54, therefore $78.54 \times 240 \times 72/33{,}000 = 41.15$ horsepower. Increasing this by twenty per cent gives 49.3 horsepower required to drive the compressor.

Notes on Ice Storage.

One of the advantages which used to be very generally claimed for an ice plant, was that it would make ice when you wanted it during warm weather, and then it could be shut down in winter so that practically all expense would stop, until it was started again as the demand for ice began in the spring. As an argument that sounds plausible enough; it avoids storage altogether, except possibly a few days' output. As a matter of fact, most plants are run this way; custom probably has a good deal to do with it, but there is nevertheless an increasing interest in the storage of manufactured ice, which is no doubt due to a better understanding of the cost of making it.

If coal, labor and supplies were the only important factors which entered the cost of making ice, a plant that could be started and stopped at will would be ideal, because except for a few employees who were kept all the year round, the cost of running the plant would stop when it was shut down. Unfortunately, this is not the case, for fixed charges never stop. They amount to a definite sum each year regardless of how much or how little ice you sell. In some lines of business they are not an important factor at all, but in the manufacture of ice they are particularly vital for the reason that ice plants are very costly



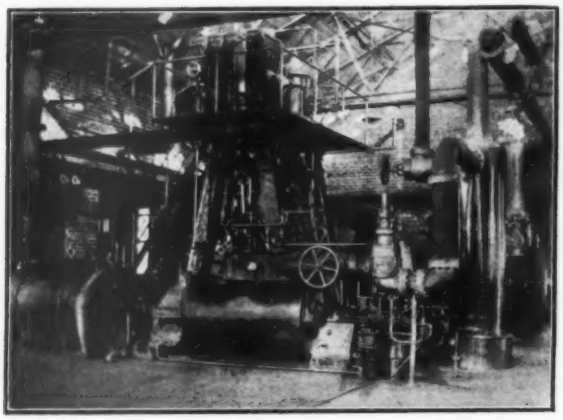
Motor-Driven Pumps in Combination Plant.

compared with the relatively small amount which a year's output of ice sells for. To make the matter more definite, suppose we take a 100-ton can plant, without storage, which represents an investment of perhaps $100,000. The fixed charges, including taxes, insurance, depreciation, repairs, etc., would probably amount to, say, eight or nine per cent. This may be considered excessive, but it can not be cut down very much if you give proper consideration to the man who invests his money in the plant, for when it is worn out there should be enough laid aside as depreciation to either return his money to him or purchase new equipment to replace the old.

In addition to fixed charges there is interest to consider, at say, six or seven per cent, which, if on bonds or preferred stock, must be unfailingly met to maintain the standing of the business. Together, fixed charges and interest amount to about 15 per cent on $100,000, or $15,000, which must be faced every year regardless of how many days the plant runs. The great majority of 100-ton can plants without storage, do not sell over 17,000 tons of ice per year and if the $15,000 for fixed charges and interest is distributed over 17,000 tons, it amounts to 88 cents a ton; practically as much as the coal and labor combined. People are beginning to realize that this is the largest single item in the cost of making ice. Careful management may reduce the coal bill or pay roll, but it cannot cut down total yearly fixed charges and interest. The only way to lighten the burden at all, is to have each ton capacity of machinery make more ice per year. Have it run at as nearly full output as possible each day in the year, and let every ton of capacity make, say, 340 tons of ice instead of 170 tons. This would cut the fixed charges and interest per ton of ice in half or reduce it to about 44 cents. Of course, this means storage for all the ice which the trade does not demand in cool weather, so that it can be held in good condition and sold during the summer.

The whole question is a financial one, and should not be settled by individual preference in favor of or against storage. For any given case the only logical way to consider the matter is to compare carefully the cost of building and operating two or more plants each capable of serving the same trade. For example, take a business of, say, 15,000 tons per year and compare a 100-ton can plant without storage with a 45-ton can plant with refrigerated storage, and a 45-ton plate plant and storage without refrigeration. The combination which shows the most liberal and certain return on the money invested is the one to build.

Do not try to figure out the storehouse by itself, or get at the cost of storage per ton and be governed by that, for you only store a part of the annual output and yet the storehouse affects the fixed charges on every ton you make. Take the plant as a whole and use the same basis in all the different cases. Be sure to make due allowance for the fact that a working force which does the same thing every day in the year is vastly more efficient than one which varies with the seasons and is largely made up of laborers who can be picked up on short no-



Engine Room of Kewanee Light & Power Company. Compressor In Rear.

Freezing Tank, Kewanee Light & Power Company.

TABLE III. OPERATING AND OVERHEAD COSTS IN MANUFACTURE OF ICE.
COST OF ICE PER TON IN DIFFERENT SIZED PLANTS AND AT DIFFERET LOAD-FACTORS.

Capacity tons ice per day of 24 hr...	5				10				15				20			
Total period of full operation, months.	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6
Yearly load-factor, per cent.....	25	33	42	50	25	33	42	50	25	33	42	50	25	33	42	50
Investment																
Mechanical equipment complete....		$6,000				8,500				12,000				15,000		
Building		1,500				3,500				5,000				6,500		
Total investment (excluding land)..		$7,500				12,000				17,000				21,500		
Daily Operating Expense																
One day engineer		2.50				3.00				3.00				3.50		
One night engineer		2.00				2.50				2.50				2.50		
One day tankman.....		....				2.00				2.00				2.00		
One night tankman.....		....				....				2.00				2.00		
Coal @ $3.50 per ton.....		3.50				7.00				10.00				13.00		
Ammonia, oil, waste and supplies...		0.50				1.50				2.25				4.00		
Net operating expense per day.....		8.50				16.00				21.75				26.00		
Net operating expenses per day per ton ice		$1.70				1.60				1.45				1.30		
Total Cost of Operation per Year																
Daily Operating Expense during period of full operation, dollars.....	765	1,020	1,275	1,530	1,440	1,920	2,400	2,880	1,958	2,610	3,263	3,916	2,340	3,120	3,900	4,680
Half of labor expense for bal. of year	608	540	473	405	1,013	900	788	675	1,283	1,140	998	855	1,350	1,200	1,050	900
Fixed Charges: 5% depreciation on cost of mechanical equipment	300	300	300	300	425	425	425	425	600	600	600	600	750	750	750	750
Fixed Charges: 2% depreciation on cost of building	30	30	30	30	70	70	70	70	100	100	100	100	130	130	130	130
Fixed Charges: 5% on total investment for repairs, taxes, water and incidentals	375	375	375	375	600	600	600	600	850	850	850	850	1,075	1,075	1,075	1,075
Total annual expense, dollars.....	2,078	2,265	2,453	2,640	3,548	3,915	4,283	4,650	4,791	5,300	5,811	6,321	5,645	6,275	6,905	7,535
Number of tons ice produced annually	450	600	750	900	900	1,200	1,500	1,800	1,350	1,800	2,250	2,700	1,800	2,400	3,000	3,600
Total cost per ton ice per annum.....	4.62	3.78	3.27	2.93	3.94	3.26	2.86	2.59	3.55	2.94	2.58	2.34	3.14	2.61	2.30	2.09
10% on investment																
Minimum average selling price to earn	6.29	5.03	4.27	3.76	5.27	4.26	3.66	3.26	4.81	3.88	3.33	2.97	4.34	3.50	3.02	2.69

tice and do not really become competent until about the time they are dropped.

How much is lost in keeping experienced men practically idle a part of each year in order that they may be available when needed the following season? In determining these questions the schedules of operation should cover an entire year in each case; figures for a shorter period are misleading. The results probably will be a little surprising; for the plant of lowest first cost may turn out a very poor investment when compared with one on which a little more money is spent to begin with.

One of the first things to be determined in any case is the proper size of storehouse. The question is often asked as to whether it is better to have a large storehouse and small plant, or a small house and larger plant. This is a matter which should be based on a very careful analysis of sales in the past, or if these data are lacking or unreliable it should be based on figures secured from a similar locality. Do not be content with the figures showing sales for one year; go back several years, for they vary considerably with the weather.

Operating Data.

Before entering into an analysis of operating conditions in several combination ice-electric plants, attention is directed to Table III giving the operating and overhead costs in commercial ice plants of moderate size under varying conditions such as are usually found in practice. The figures, while not applying specifically to combination plants, will give a general idea of the conditions to be met.

In Kewanee, Ill., the manufacture of ice has been extremely profitable. For the year ending November 30, 1912, a net profit of $4,883.96 was made on ice alone. These figures, however, do not take into consideration interest on the investment, insurance and depreciation, which are carried in the electric station capital accounts.

The ice plant of the Kewanee Light & Power Company is a compression plant, comprising a 30-ton De La Vergne steam-driven compressor. Views of the freezing tank and of the compressor are shown in the accompanying illustrations.

The population of Kewanee is approximately 15,000 inhabitants. The ice sales for the past year, in tons, were: December, 1911, 110.25; January, 1912, 56.55; February, 218.25; March, 104.70; April, 169.35; May, 227.85; June, 312.45; July, 726.30; August, 657.75; September, 533.85; October, 226.35, and November, 144.45, a total for the year of 3,488.10 tons, for which an average price of $2.75 per ton was received. All ice is sold to a local dealer, except that which is shipped to nearby towns.

TABLE IV. KEWANEE LIGHT & POWER COMPANY.

	Sales		Operating		Supplies & Expense				
	Tons	Dollars	Fuel	Wages	Supplies	Wages	Misc.	Maint.	Tons Made
1911									
Dec.	110.25	317.95	49.88	20.20	8.19	1.70	6.36	34.30	79.8
1912									
Jan.	56.55	197.45	35.62	12.25	61.38	21.30	3.95	16.50	57.
Feb.	218.25	414.45	137.50	39.55	77.48	12.80	8.29	24.49	220.8
March	104.70	296.90	80.00	31.70	100.51	46.80	5.94		127.8
April	169.35	481.95	106.25	124.90	45.70	52.40	9.64		169.8
May	227.85	620.35	137.00	164.86	66.74	9.60	12.41	18.15	252.3
June	312.45	837.25	218.40	62.55	79.23	15.75	20.80		311.70
July	726.30	1,970.00	444.08	159.86	170.12	24.99	40.30	1.25	733.05
Aug.	657.75	1,905.51	371.82	162.44	108.62	29.80	38.11	3.48	612.90
Sept.	533.85	1,549.43	254.07	226.86	149.27	18.20	39.42	10.27	564.60
Oct.	226.35	646.06	87.21	111.81	54.70	13.30	20.48	.60	191.25
Nov.	144.45	409.21	74.11	70.64	71.29	6.84	13.84	2.54	164.4
Total 3,488.10		9,646.49	1,995.94	1,187.62	995.57	252.58	219.54	111.58	3,485.20

The accompanying table (IV) gives in detail the operating costs at the Kewanee plant for one year. Fuel is charged against ice operation at a given rate per ton of ice made. This rate is varied as conditions seem to warrant. The wages account includes a portion of boiler-room wages and wages of help employed entirely in the ice plant. The item of supplies and expense includes, in addition to items ordinarily covered by such an account, the cost of loading ice which is shipped out of town and a portion of office expense:

Commenting on combination plants, Elmer W. Smith, manager of the Kewanee plant, says: "It is our opinion that ice-making can be profitably combined with an exhaust-steam-heating system for a non-condensing central station."

At Charleston, Ill., the Central Illinois Public Service Company is operating a 20-ton ice plant with satisfactory results. The population of Charleston is about 7,100. The electric station serves a connected load of approximately 622 kilowatts, the average weekly station output being 6,000 kilowatt-hours.

The ice plant comprises a 20-ton York steam-driven compressor, with the usual auxiliaries. The plant operates at its full capacity from March to October and produces about 20 tons per week the remainder of the year. A storage room of 60-tons capacity is installed in connection.

Ice is sold at an average rate of 35 cents per 100 pounds to retail customers and 20 cents per 100 pounds to buffets, butchers, ice-cream parlors, etc. Three teams are employed to distribute ice during the summer season.

The accompanying table (V) shows in detail the operating expenses and monthly revenue for several months. The figures, however, as regards fuel cost, hardly indicate the true status of affairs, as a fixed percentage of the total coal cost is charged to the ice plant regardless of ice production. As the company also does a steam-heating business, to which a portion of the coal is also charged, the winter months, if unusually cold, work an unfair hardship on the ice-operating figures under this method of apportioning charges. In spite of this the ice business shows a profit for the entire operation:

If figures were available for the months of September, October, November and December, the profit would be materially increased, as the heaviest ice sales of 1912 occurred during the latter part of the summer.

At Hilsboro, Ill., ideal conditions obtain. The Hilsboro Electric Light & Power Company has a new modern turbine station, in one portion of which is installed a 30-ton ice plant of the absorption type. Exhaust steam from boiler- feed pumps and auxiliaries is used in summer, and in the heating months the company does a steam-heating business. For a typical month, September, 1912, the estimated ice made per ton of coal consumed was 8.94 tons. For October, 1912, the ice-plant expenses were: Wages, $149.55;

TABLE V. CENTRAL ILLINOIS PUBLIC SERVICE COMPANY.

	Coal	Labor	Maintenance of Pumps	Maintenance of Compressor	Miscellaneous Supplies	Office Salaries	Miscellaneous General Expense	Dist. Exp.	Water	Lubricants Waste	Total	Revenue
1912												
Jan. ...	133.						6.65	137.85		6.81	284.31	146.17
Feb. ...	133.							230.51			363.51	61.37
Mar. ..		17.19	7.35				1.25	64.35			90.14	109.00
Apr. ..		15.01	6.60	42.44	37.50		13.62	184.75		12.00	311.92	462.62
May ..		236.94	.60	99.22		17.50	10.09	240.85	25.00	31.94	662.14	785.40
June ..	479.	220.87		3.65	1.25	17.50	13.68	258.77	25.00	5.27	1,024.99	1,026.51
July ..	543.92	278.35	15.50	79.29		17.50	8.72	392.38	25.00	25.86	1,386.52	1,902.53
Aug. ..	445.42	272.37			5.41	17.50		381.81	25.00	11.38	1,158.89	1.407.25

$900.85

fuel, $27.50; power, $100; supplies and expense, $89.30; depreciation, $181.66, and maintenance, $50; a total of $598.01. For the same month the ice receipts were $815.41, a net profit of $217.40.

The Nashville (Ill.) Electric Light Company is another company operating an ice plant with marked success. The ice plant is a 7-ton Huerceles, driven by a steam engine. During the warm months 45 tons of ice are produced, but the demand has increased to such an extent that a larger machine, motor driven, will be installed in time for next summer. Ice earnings for the summer months of 1912 were: June, $759.91; July, $877.53; August, $747.28; September, $983.98. For these four months the net profits averaged $500 per month. The net profits for an entire year average $400 per month. Nashville has a population of 2,135. Ice is sold for $4 per ton wholesale and $8 per ton retail. The investment in the ice plant is between $8,000 and $10,000.

A typical combination ice-making and electric-generating plant in a small middle western town of about 3,500 inhabitants is of interest, as the ice profits for the year have proven greater than the profits from the electric plant. The plant is of the absorption type and has a rated capacity of 10 tons per 24 hours. During the months of June, July, August and September last year the plant produced 2,194,180 pounds of ice, which, at the current retail prices, ranging from 30 cents to 50 cents per 100 pounds, according to quantity, brought in $6,883.13, or an average of $6.36 per ton. During this time it should also be understood there was a coal scarcity, and coal cost as high as $4 per ton.

From the preceding figures it is seen that the profits on the ice for the four months amounted to $3,545.05. After deducting fixed expenses of $391.87, which includes charges to cover insurance, taxes, etc., this leaves $3,153.18. Charging 5 per cent for depreciation on the $17,500 investment shows a net profit during the four months of $2,300, representing a return of 13 per cent on the investment.

The schedule of rates under which the above ice was sold follows: Retail to the small consumer, 50 cents per 100 pounds; where two tons per month are used, 40 cents; over four tons, 35 cents, and over eight tons, 30 cents. All of the excess ice over and above the requirements of the town was sold in car lots at $3.25 per ton.

A certain 25-ton combination ice-electric plant in a Texas town having a population of 8,000 represents an investment of $40,000 in the ice department of its business. This investment is divided as follows: Buildings, $12,000; ice-making equipment, $22,000; 75-ton ice-storage room, $3,500; wagons, $2,500.

The cost of making and delivering a ton of ice in this town is about $4.50, including all plant expenses, fuel, delivery charges, overhead, etc About three tons of ice per ton of coal are produced.

The average rate for which the ice is sold is $6.50 per ton. Last year, during a season of 150 days, 4,000 tons of ice were produced, bringing a gross income of $26,000. The total operating expenses in producing this ice were $18,000. This left $8,000 net revenue, which applied on the total investment of $40,000 represents an income of 20 per cent.

O. B. Welch, vice-president of the Williamson (W. Va.) Light & Ice Company, commenting on combination plants, says:

"My experience in the ice business is that it will put many a poor-paying plant on a dividend-paying basis. We have in Williamson a 10-ton plant, steam operated, and our revenue is a little better in the summer than in the winter months. We operate with the same help the year around, with the exception of during the ice season we use a boy on the tank floor to pull the ice and load the wagons. This costs $2 for the 24 hours' run. I believe a plant that is trying to put on a day circuit could have a nice business by adding an ice plant. At present we have plans partly made for increasing our plant to 25 tons. In this increase we expect to use a motor-driven plant and shut it off during the peak load. During the valley of the load curve we expect to operate the ice plant. As we are operating the light plant on an all-day service, we can in this way bring up the efficiency of our electric plant.

"We use the can system. The population of Williamson is 5,000. We operate the ice plant 12 months in the year. Of course in the winter season we only run the ice plant enough to supply the demand. In this way we carry the surplus ice in the freezing tank and not in the storage. We sell our ice to a local dealer, who does the delivering to the customers. We get a price of $4 per ton for eight months and $3.60 per ton the rest of the year at the plant. I believe there would be good money, however, in a company handling its own ice. We have no record of cost, as we do not separate the operating, i. e., coal and labor for power house, as we use the same men for both."

Herewith is a schedule of the ice output for the year 1911; also the coal:

	Ice tons	Coal tons
Jan.	22.8	455
Feb.	24.2	355
Mar.	28.5	370
Apr.	40.4	369
May	125.0	445
June	161.8	476
July	148.7	472
Aug.	166.1	390
Sept.	158.2	445
Oct.	107.9	443
Nov.	336.4	390
Dec.	131.5	390

An analysis of this will show that the ice plant did not increase the coal consumption appreciably.

Electricity in Brick Making.

That electricity is making strides in the clay-working industry in Louisville and Kentucky is evidenced by recent developments in the Bluegrass state. Hitherto brick and tile factories have for years presented almost insurmountable difficulties to central-station men, for it was by no means evident that opportunities exist in this industry for consumption of current to an advantage, but subsequent features in Kentucky have proved otherwise.

The Coral Ridge Clay Products Company, of Louisville, which was recently incorporated with a capitalization of $100,000 to engage in the manufacture of brick, tile and other clay specialties, is to establish an immense plant at South Park, a few miles south of the city, and will be ready for operation in spring. The plant is to burn clay products by a special process of electrically-fired kilns which is believed to typify the most advanced method of handling this operation of the industry. Hitherto coal and coke fires have been used exclusively in brick-making.

The utility of electricity in another phase of clay-working has been demonstrated by the Louisville Brick Company, at 38th Street and Rudd Avenue. This company has wired its plant complete with arc and incandescent lamps and has contracted with the Louisville Lighting Company for current which will enable it to run full time during the dark months of January, February and March, as well as permitting overtime work even when the days are longer. The illuminating improvement is considered by President Joseph Nevin to be one of the most valuable ever made by the brick company, for under ordinary circumstances the yard has lain idle three months of the year.

Large Russian Central-Station Company to Use Peat for Fuel.

The Moscow Electric Company, which supplies the lighting and power service of the city of Moscow, Russia, has purchased an extensive area of peat swamps and is starting the production of peat with improved machinery. Heretofore this company has employed fuel oil.

Commercial Practice
Management, Rates, New Business

ELECTRIC WAGON IN DENVER —FACTS AND FIGURES FOR THE CENTRAL-STATION MANAGERS.

By J. A. McMeel.

The real value to the central station of the electric-vehicle load has only recently received the attention which it rightly deserves. At the beginning of the present year, or but a short while before, a great many of the larger central stations in different sections of the country began to take an active and serious interest in the development of the electric-vehicle load. Some companies have gone into it on a more elaborate scale than others, but it is safe to say that every electric-lighting company which made the venture of directly or indirectly pushing the sale of electric trucks or pleasure cars has been amply compensated for its expenditure of money or energy. It is probable, at least persistent rumor has it so, that the electric-truck sales reached the highest mark in their history during 1912 and reports from every section of the country seems to indicate that 1913 will be the most prosperous year in the history of truck manufacture.

Sales conditions in Denver during the present year have been the best ever experienced. Although there was not a large number of commercial cars sold, the progress nevertheless has been substantial. All told 15 trucks, varying in capacities from 750 pounds to six tons were purchased by Denver merchants and the electric vehicle is now established on such solid footing that greater returns are expected next year. This figure does not include the trucks bought by the Denver Gas & Electric Light Company, which has purchased eleven commercial wagons of a variety of capacities during 1912.

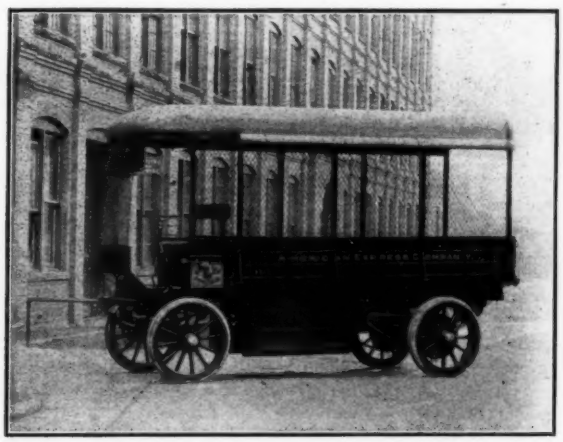
There have been a number of factors responsible for this increase. As has been stated before in the columns of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, the Denver Gas & Electric Light Company has taken an active part in pushing electric vehicles and in bringing the advantages of electric delivery to the attention of the local business men. Through the efforts of a solicitation department, which has been backed up with effective advertising through a monthly publication—"The Electric Vehicle"—and newspaper advertising, much of the success accomplished is due. In addition, a closer and more intimate relation with the agencies for the different trucks and pleasure cars has been established, and through the work of these forces the electric track has been given a place on the map.

In regard to the agencies in Denver, that city is very well represented both with pleasure car and truck manufacturers. In the electric-vehicle line the manufacturers having Denver representatives are the General Vehicle Company, Waverley Company, Baker Motor Vehicle Company, Anderson Electric Carriage Company, Fritchle Automobile & Battery Company, Rauch & Lang Company and Hupp-Yeats Company.

The topography of Denver makes this city a veritable playground for electric vehicles. There are no hills to speak of and the grades on such hills as there are scarcely reaches the six-per-cent mark. Weather conditions are also favorable to the operation of electric vehicles. The winters as a rule are mild, with very little snow, and there is not a great amount of rain in summer. Good roads are also numerous, and with the exception of a few places on the outskirts of the city all conditions are ideal for the operation of commercial wagons or pleasure vehicles.

In view of these conditions it would seem that a much better development should have been shown during the present year, but as the educational work of the central station has only been earnestly started, and as the average business man is rather slow to progress after he learns the facts about trucks, the development up to the present time has been as good as could be expected. It is almost certain, however, that during 1913 this record will be outstripped by about four to one. There are quite a number of the larger concerns in the city looking into transportation conditions at the present time, and as most of these are dry-goods establishments and companies operating their delivery systems within the limits of the city proper, and as their business calls for frequent stopping, it is almost a certainty that electric machines will receive the preference over cars of other types. Besides this feature there is the re-order business to consider. Most of

1,000-Pound Detroit in Service of Knight-Campbell Music Company.



Baker Electric in Service of American Express Company.

the firms now using electric trucks have delivery systems large enough to require several more cars and as every electric truck owner in Denver is thoroughly satisfied with the work the cars are doing, it is only natural to expect that these companies will buy additional machines.

The electric trucks in use in Denver have been of a two-fold benefit. They have increased the central-station load materially, and in addition they have saved money and done better and more work for the companies owning them—a very satisfactory state of affairs. Among the 40 truck owners in Denver it would be impossible to find one who is not entirely satisfied with the work done by the electric machine in his service. Most of them will boost the truck whenever the opportunity offers itself, and this good feeling on the part of the men owning electric wagons naturally instills a confidence in the merchant or business man contemplating the purchase of electrics.

One concern, the Knight-Campbell Music Company, one of the largest businesses of its kind in the West, was so well pleased with the service given by the first electric truck purchased, that a few months afterwards another car was added. In speaking of his trucks, C. G. Campbell, of the music company, exhibited a genuine satisfaction with the results secured and said that the machine, which is a 2,000-pound General Vehicle, effected a saving of about $100 a month. Of course, this amount varied, but during the first few months of service the saving over horse equipment reached that amount. On the strength of this feature the company added another machine, a 1,000-pound Detroit car, equipped with Edison batteries, with the view to eliminating a $120 monthly expense for hauling small articles of music store merchandise. Not only is the management of the establishment satisfied with truck service, but the men employed by it also esteem the electric very highly. The foreman for this company tells an interesting story about the first machine installed by the Knight-Campbell company which speaks volumes for the dependability of the electric truck. Two pianos, weighing in the neighborhood of 2,000 pounds, were loaded on the machine and hauled to Morrison, Colo., a distance of 17 miles from Denver. This work was done early in the morning and the machine did the usual work specified for it during the day. Another interesting bit of information was also brought out when the driver was discussing electrics with the writer. He told how the machine had worked through one of the outlying districts, when the electric had negotiated "hub-deep" mud without the slightest trouble.

In the case of the Knight-Campbell Company is found an example of a satisfied user and satisfactory electric truck service. However, there are many other interesting features connected with the operation of machines of this type. The Daniels & Fishers Company is one of the largest department stores in the city. Three electric trucks, a Detroit 1,000-pounder and two Fritchles of the same capacity, are employed for delivering small packages. C. MacA. Wilcox, manager of this establishment, is well pleased with the trucks. Packages are being delivered at a cost of three cents each, while with horses the expenditure was 4.5 cents a package. A saving of 1.5 cents on every package is being made by the use of electrics. These figures were given out when the company had only two machines, but since the installation of the third car it is likely that a greater saving per package is being made. The Daniels & Fishers Company will never go back to horses, so satisfactory has been the service given by electric cars.

Another instance which should be a strong recommendation for the electric may be found in the Studebaker car owned by the Senter Pie Company. Information supplied by A. J. Senter, proprietor of this establishment, which was one of the first companies in Denver to adopt truck service, gives a very good illustration of battery life. After his car had been worked every day for 33 months the total expenditure for repairs amounted to $50. The only other expense incurred was $200 for replacing parts to the battery, and Mr. Senter expressed his appreciation of the service he was getting from the machine and stated that he was somewhat surprised at the low cost of operating it. The examples enumerated are only a few typical of Denver service and many more of interest could be given.

With few exceptions most of the merchants owning trucks house them in one or another of the public electric garages in the city. There are only three concerns, outside of the central station, which are garaging the machines in buildings of their own. All of these are bakeries and the trucks are charged, washed and housed in the bakeries. The rate for storing cars charged by the public garages is $90 a month. This includes charging, washing, painting once a year, and giving the machines all the necessary attention. As far as can be learned this method of housing the machines is satisfactory, but it is probable that as soon as the companies following that practice purchase more cars a modern electric garage will be constructed.

There are six different lines of business in the city using electric delivery service at the present writing. A total of 39 cars are employed, three in the express business; six by bakeries; four, department stores; two, music company; one, coal company; 23 by the electrical interests in the city.

750-Pound Electric in Service of Campbell-Sells Baking Company.

Regarding the pleasure vehicle situation here it is enough to say that in June, 1910, there were 480 pleasure vehicles in use in the city, and today there are 850 of this type. The sales during the present year have added materially to this number.

The Denver Gas & Electric Light Company is doing everything in its power to encourage the sale of pleasure vehicles as well as trucks. The company's rates for charging to private garages for off-peak business are $5 a month, minimum, plus four cents per kilowatt-hour over and above the minimum. Peak charging increases the minimum to $7.50. These rates are subject to a 10-per-cent

discount. For public charging stations the rate is three cents a kilowatt-hour, with the discount based upon the quantity used during a month. The electric-vehicle load at Denver calls for the delivery of 2,160,000 kilowatt-hours and the annual yield in revenue amounts to $64,800.

Electric Christmas Tree in New York.

With a tree and a carol, the Christmas spirit was revived in New York, and thousands of dwellers in that busy town where sentiment is supposed to lie dormant, paused in their hustle and bustle to gaze at a thing of beauty that blazed against a back-ground of park elms and tall buildings. It was the "tree of light," to provide cheer for those in whom the spirit of Christmas might need awakening, and all the holiday week it gleamed every night in the darkened park.

It was just a week before December 25 that plans were put in motion, but so well was the work executed that the whole program had been arranged, the necessary permits obtained and the tree, a gift of the Adirondack Club, on its way from the forests before even a word of the coming surprise reached the public. In fact, it was the actual arrival of the 60-foot balsam pine at the park that first began to attract attention, and the work of the New York Edison Company's electricians, who began at once to wire the branches.

The out-door Christmas was a gift in every sense. The tree was presented by a club, its transportation was donated by the railroad company, it was erected by an interested New Yorker, the wiring was a gift and the illumination was provided by the lighting company. Even the soloists, the choral societies, and members of the band gave their services without cost to the committee.

Electrically Lighted Christmas Tree in New York Park.

Eight-candlepower lamps were used for the illumination. At first it was thought 1,200 would be sufficient, but at a trial illumination it was found these hardly did the tree justice, so 1,800 more were added the next day, the electricians, among them a number of the men who wired St. Patrick's Cathedral during the 1911 blizzard, working during the snowstorms to have the lights ready in time. The circuits all came to a switchboard installed at the base of the tree, and from this all the lights were controlled. Current was taken to the tree from the Edison mains in Madison Avenue and Broadway, the wires being carried from the street through the branches of the park trees. The lamps burned from dusk to midnight.

Christmas also found all district show rooms of The New York Edison Company decked in unusual beauty this year. Although the holiday season is observed with appropriate decorations every year, nothing was spared to make this one to be remembered. In all of the offices were tall Christmas trees which topped to the ceiling all a-glitter with tiny multi-colored electric lights. Ropes of greens were festooned from the ceiling and walls, while wreaths of holly hung wherever there was a space. The windows were especially artistic in their array of appropriate electrical Christmas gifts. One of the windows at 124 West Forty-second Street was filled with dollies attired in Christmas colors and holding little colored lamps in their hands which flashed intermittently. The Bronx district office brought forth much favorable comment and was rivaled in attractiveness by Harlem, Broadway and Delancy Street. Just before the office closed on Christmas Eve the trees and decorations were sent to churches, hospitals and charitable societies.

Interior of New York Edison Show Room.

Christmas Tree in Show Room.

Electrical Construction

SOME UNUSUAL ELECTRICAL EQUIPMENT AND CONSTRUCTION FOR RESIDENCE SERVICE.

Notes on a High-Class Installation.

Within the last year or two a great deal has been written concerning the use of electricity in the home; but much of this has been meant to show how electricity may be employed to lessen the burdens of housekeeping in homes where, for any reason, efficient help cannot be kept. In the design of the residence installation, with which this article is concerned, however, the so-called servant problem did not have to be taken into consideration at all; but there was an adequate appreciation on the part of the property owner of the many advantages of a generous use of electrical appliances in even a home where there is no lack of servants, and the electrical contractors were requested to put in an equipment which would be modern and complete and to employ only the best methods of construction in the installation of all apparatus and appliances. That this request was well complied with the following notes attempt to show.

The electrical contractors are Bond Brothers & Company of Evanston, Ill.

The residence in question is located in one of the suburbs of Chicago, where electric service is obtained from the distribution lines of the Public Service Company of Northern Illinois. It is a framed building and is two stories high, with basement and attic. The main part of the house covers an approximately rectangular ground area which is about 75 by 50 feet in dimensions, and there is a wing or ell having a ground-floor area of about 35 by 25 feet. It is well to bear these approximate dimensions in mind; the relation between the size of the building and the amount of electricity to be ultimately used is most interesting. There is also a garage large enough to accommodate three or four touring cars, and over this are chauffeurs' living rooms. As parts of the garage building, there are rooms containing a small ice-making and refrigerating plant, a vacuum cleaner and other apparatus to be mentioned later. The garage is connected with the basement of the residence by a tunnel of sufficient width and height to make a convenient passage way between the two buildings, and on its walls and ceiling conduits carrying electric circuits and other lines of piping are run.

Service for Power and Light.

Throughout the entire installation the power and the lighting circuits are kept separate from each other.

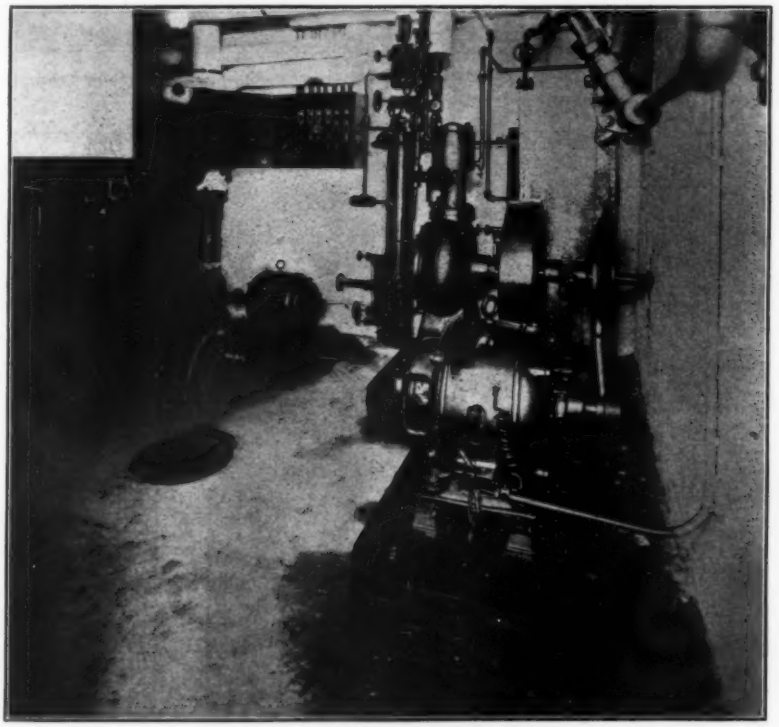


Fig. 1.—Part of Refrigerating Plant.

The service is supplied from a large transformer installed on a pole on the opposite side of the street from the residence grounds. From the base of this pole two underground circuits are run to the main service cabinet, which is located in the garage building, and which is shown in Fig. 2, there being a manhole just outside the building mentioned, which was provided for pulling in the underground cables and for taking off a branch circuit to supply current to a neighboring residence. The distance of this manhole in the yard from the transformer pole is 300 feet.

The circuit run from the transformer to the manhole for supplying power to motors in the residence consists of two No. 00 lead-covered conductors, while for lights there are three No. 0000 lead-covered cables. Medium-tension Okonite cables are used.

The power and the lighting service switches are shown in Fig. 2, as are also the power and the lighting busbars and feeder switches. It is very seldom that one sees so large a service on in a private residence. The switches and busbars for lights are on a separate slate panel, it will be noted, from the one on which the motor-circuit switches are mounted, the two panels being separated by a narrow panel which can be removed to make the lighting and power panels more accessible.

Motor and Other Power Equipment.

As already indicated, the residence under consideration has its own ice-making and refrigerating plant, and the machinery in this plant is all motor driven. The two motors in

this plant are shown in Fig. 1; the larger one is five horsepower in capacity and the smaller one two horsepower. These motors, and all others in the installation, are of the single-phase, self-starting type. In the same room with the motors which drive the ice-making machinery there is a Tubee vacuum cleaner, which supplies a

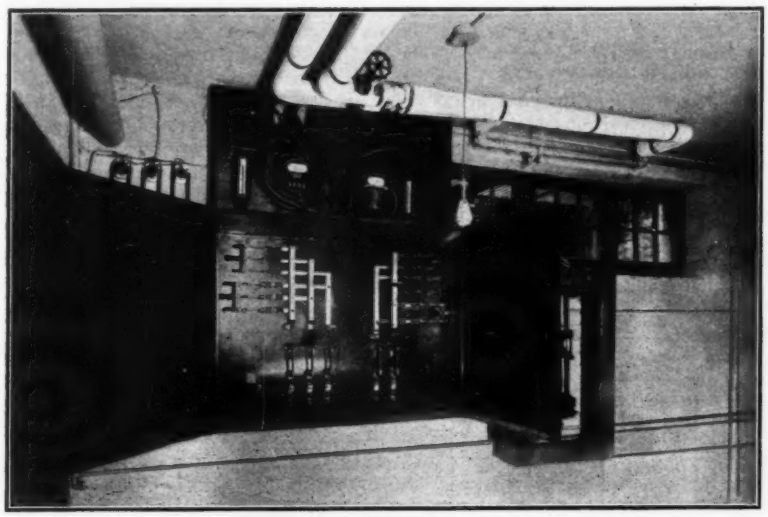


Fig. 2.—Main Service Cabinet.

vacuum for cleaning to all parts of the residence and the garage. This is driven with a three-horsepower motor.

For keeping up the pressure in a compressed-air tank the motor-driven compressor shown in Fig. 3 is employed. The capacity of this motor

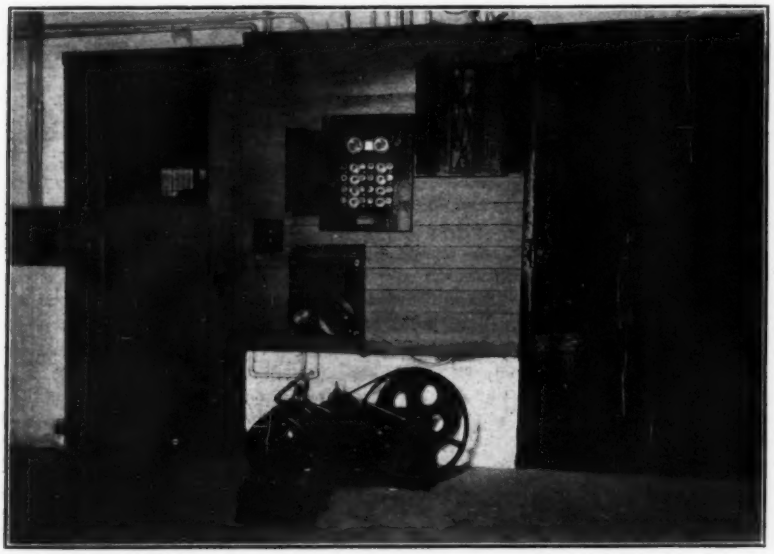


Fig. 3.—Air-Compressor Installation.

is one horsepower, and it is switched into service automatically whenever the pressure in the compressed-air tank falls below a predetermined value. This tank is employed to keep the automobile filled with compressed air.

The surface water from the extensive grounds around the residence drains into a small reservoir in the basement of the garage, and from here it is pumped into the sewer by means of a motor-driven rotary pump. This pumping set is in duplicate, the arrangement being such that in case of accident to one unit the other can be depended upon to take its place. The pumping service is made entirely automatic by the use of motor switches controlled by means of floats. The pumps and the wiring to the motors are very well shown in Fig. 4.

It was planned originally to drive the machinery in the laundry of this residence from a line shaft belted to a three-horsepower motor; but for this arrangement three one-horsepower motors, connected directly to the machines to be driven, were finally substituted.

In addition to the motors already mentioned there are some small machines for driving other devices designed for residence service. There is also a five-kilowatt electric range in the kitchen and an electric plate warmer.

The garage is equipped for charging storage batteries by means of a mercury-arc rectifier.

Lighting Installation.

The total number of incandescent lamps in the residence is 336, and there are 59 lamps in the garage. Moreover, at each one of the two entrances to the grounds ornamental standards, with clusters of incandescent lamps on them, are being installed. In the bases of the posts connections will be provided for attaching temporary circuits for decorative lighting throughout the grounds whenever

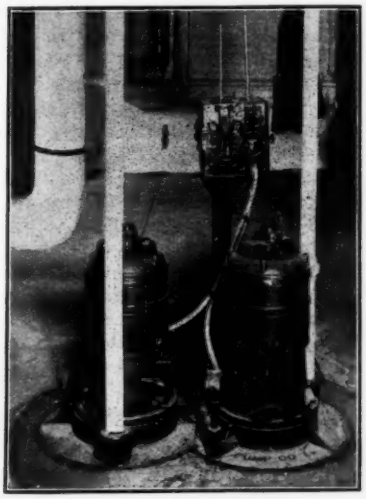


Fig. 4.—Drainage Pumps.

illumination of this sort may be desired. When this part of the installation has been finished a load of six kilowatts can be carried from the bases of these standards.

Besides the lamps on fixed sockets in the residence, there will be a liberal use of portable electric lamps in the residence. For putting these and other small appliances in circuit whenever it may be desired to do so, 25 base plugs have been installed and two floor-outlet boxes provided.

Telephone Service.

Although there are standard telephone systems on the market especially adapted for intercommunication between the rooms of a private residence, the use of such systems in private residences is by no means so general as, in view of the convenience of the thing, one would ex-

pect to find it. The house telephone installation in the residence with which this paper is concerned has a number of 'phones, and these are distributed in the most convenient locations throughout the building. From any of these telephones any room having a telephone in it may be called and talked to at will, or the city telephone exchange may be called for any outside connection desired. The person desiring to talk cuts his telephone into the proper circuit by pushing a switch underneath the transmitter box. The system is practically one of the Western Electric Company's standard house telephone installations.

The call-bell installation in the residence, which may be mentioned here, in-

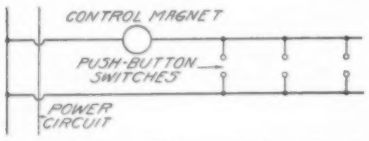


Fig. 5.—Vacuum-Cleaner Control Circuit

cludes annunciators in certain servants' quarters for indicating the room from which a signal comes. The ringing circuits are supplied with current from a bell-ringing transformer.

Arrangement of Circuits.

The character of the service circuit from the transformer to the garage has already been discussed. This part of the installation will be referred to again in some construction notes which are to follow. The motor cutout cabinets in the garage and in the rooms adjacent thereto are fed directly from the service cabinet, and likewise the garage lamps. From the main service cabinet circuits are run in conduits through the tunnel already mentioned to supply service to the resi-

Fig. 6.—Section of Tunnel Carrying Conduits.

dence. In the residence there is a distributing panel on each floor from which circuits radiate to the various outlets. Panels for basement lamps and the electric range are contained in a cabinet at the residence end of the tunnel.

On the first floor there are 26 branch lighting circuits, while the second floor has 18 circuits. The branch-circuit distributing panels are located in the servants' halls. They are inclosed in substantial cabinets, of neat appearance.

For controlling lights on branch circuits there are 107 push-button switches. All stairway lights are provided with three-way switches, and in bathrooms having two doors, three-way switches are installed, so that the lights may be controlled at will from either door. The switching arrangement on the outdoor lighting is such that the yard lights can be turned on and off from either the butler's room or from the garage.

The vacuum-cleaner motor is provided with one of the Cutler-Hammer Manufacturing Company's remote-control switches, and it was intended to install in the control circuit of this motor switch a combination of switches like that shown in Fig. 7. In this figure the motor switch is shown at the left, the

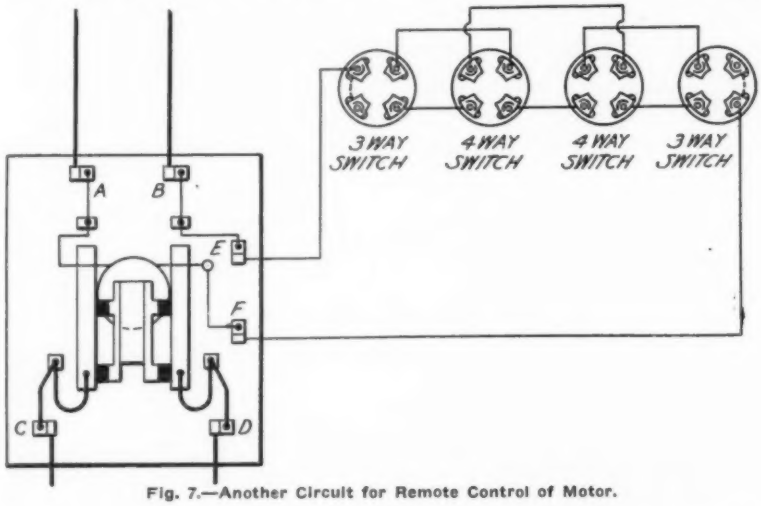


Fig. 7.—Another Circuit for Remote Control of Motor.

upper broken wires being a part of the circuit from the source of power and the lower ones the motor leads. When the circuit containing the three-way and four-way switches is closed an electromagnet is energized, and this magnet closes the motor switch and the motor starts. The property owner decided, in the case of the installation in question, that with three-way and four-way switches there might be some annoyance from servants in one room stopping the vacuum-cleaner motor while a servant in some other room was using it. Hence the control shown in Fig. 5 was adopted. Closing any one of the push-button switches in the control circuit energizes the solenoid, or electromagnet, of the motor switch and starts the machine, which will usually run until the control circuit is opened at the point from which the motor was started.

Other Construction Notes.

This being a frame building, the methods employed in running the risers and branch circuits need not be gone into in any detail. It is understood, of course, that all circuits were run in conduits. These were carried up between the vertical studding and run concealed between floors and ceilings in the usual manner. In running the underground lines between the transformer and the house and between the house and the gate lamps, however, some special work had to be done, particularly in connection with the circuits from the transformer.

It will be recalled that the distance from the transformer to the manhole in the yard is 300 feet and that five lead-covered cables had to be drawn in between these two points. Waterproof tile was installed for the cables, the tile being run so that it would drain into the manhole in case water should ever find its way into it. The manhole drains into the sewer.

The tile, which was laid in concrete about four feet underground was threaded over a galvanized-iron wire as successive lengths of it were put in place. When the run was complete, a stranded-steel cable was pulled into the tile duct by means of the galvanized-iron wire mentioned, and this used to pull in the first of the five conductors. A winch had to be employed to pull the lead-covered cables in, and every time a conductor was drawn into place the galvanized-iron wire was drawn in with it, ready to be employed in drawing the steel cable back through the duct. The wire was run over the top of an empty reel installed near the transformer pole and the pulling back was done by means of a heavy automobile car which the electrical contractors were using. During the pulling in of the cables axle grease was used in large quantities to lubricate the interior of the tile duct.

From the base of the pole up to the transformer the service wires are run in a four-inch iron conduit 20 feet long, which is terminated in a condulet fitting. The junction of the iron pipe with the tile duct was made with a sewer-pipe

elbow. The male end of it is jointed with the tile duct, and into the flanged end the four-inch conduit was set, after which the elbow was filled with concrete. Besides making the joint water-tight, the concrete formed a good support for the vertical pipe.

Organization.

The average contractor's bookkeeping, together with his cost keeping, is so definite that he does not know until a contract is complete, or until the end of the year, or until he goes out of business, or dies, whether he has made any money or not.

He may make money on one operation and lose it on another, or on one contract and lose it on another; he gets too much for one operation or one contract and not enough for another.

Then comes the moral effect of a lack of definite knowledge of cost. The shrewd owner finds that costs are a matter of opinion and he at once undertakes to change that opinion by applying horse-buyer methods in order to get his building as cheap as possible; the contractor, in turn, takes this as a moral license to "trim" the owner at every point.

The owner comes back with bonds, forfeitures and iron-clad contracts.

The solution of this evil is in very simple local organization of contractors, not to control prices, but for the purpose of educating each other to costs.

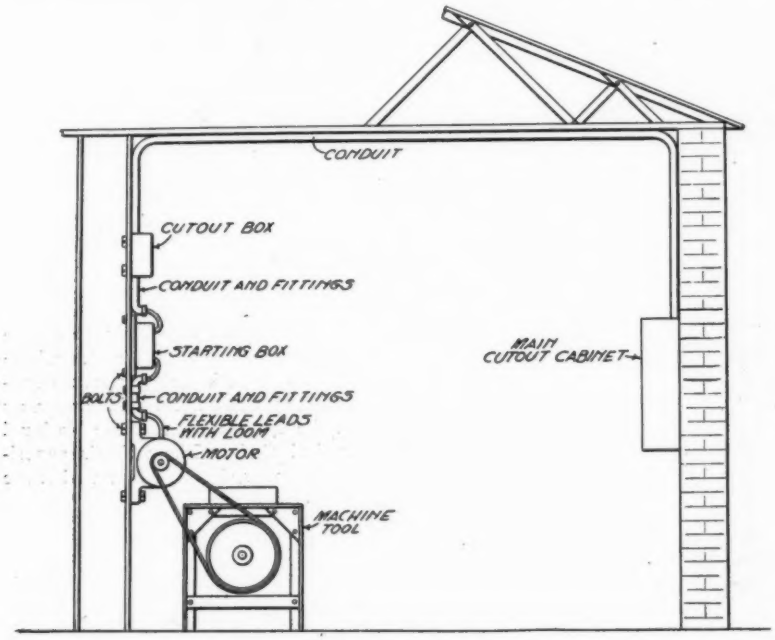
Price will take care of itself, naturally, if each knows his cost.—*Common Sense.*

A NOTE ON THE INSTALLATION OF SMALL MOTORS.

By H. G. Wilson.

The satisfactory installation of small motors for individual drive when the motors are not inherent parts of the machines is often a problem.

One solution was arrived at, in an installation the writer has in mind, by using the steel roof supports as a motor base. Several small machine tools such as hack saws, etc., were placed close to the steel columns and the motors bolted thereto as shown in the diagram. Conduit was then run from the main cabinet across and along the roof trusses, thence down the posts to the cutouts and starting-boxes; it was also bolted to the same base as the motors, and from them to the motor terminal blocks.



Wiring to Motor.

This not alone saved floor space and the usual troughing of the concrete floor for the conduit but kept the motors up out of the dirt as well.

Movement to Provide for More Thorough Inspection of Old Wiring in Chicago.

The bureau of electrical inspection of the Department of Electricity of the City of Chicago is asking the Finance Committee of the City Council for an appropriation to provide the bureau with twelve additional electrical inspectors. It is planned to put seven of these twelve on the work of inspecting old wiring. Thus, if the recommendations of the department are adopted, the city will have a regular force of eight inspectors looking after old installations.

Installation of Motion-Picture Machines.

The necessity of properly safeguarding moving-picture theaters against fire is too well appreciated to need to be commented upon. A number of fire underwriters' boards have recently adopted specific rules covering the installation and equipment of theaters of this sort, the rigid observance of which rules are insisted upon where the theater carries fire insurance. This matter is gone into very thoroughly in a set of rules lately adopted by the National Board of Fire Underwriters. Those portions of these regulations that have to do with the electrical work in the moving-picture show house are given, in substance, in the following; they should prove interesting to electricians in general. The rules are prepared in the form of an ordinance, and its adoption by municipalities is suggested.

The arc lamp used in a motion picture machine must be constructed and installed as follows:

(*a*) Must be substantially constructed, entirely of metal except where the use of approved insulating material is necessary.

(*b*) Must be so designed as to provide for proper ventilation and to prevent sparks being emitted from lamp when it is in operation, and mica must be used for frame insulation.

(*c*) Self-closing doors must be provided on side and rear of lamp inclosure, and observation ports not larger than two inches square may be provided when they are closed with glass.

(*d*) Lamp must be controlled by a double-pole switch within easy reach of operator.

(*e*) Conductors supplying current to lamp must not be smaller than No. 6 B. & S. gauge or its equivalent. Stranded conductors, provided with approved lugs, must be used between lamp and permanent wiring. A fireproof insulation must be used on conductors inside the lamp and those connected to the arc lamp and resistance. Conductors passing through case of the lamp must be protected with porcelain bushings.

(*f*) The resistance box must be kept not less than one foot from any combustible material, or must be separated from it by a slab of slate or marble. The resistance box must be surrounded with a substantially attached metal guard having a mesh not larger than one-half inch, which guard is to be kept at least one inch from outside frame of the rheostat.

(g) The lamp must not be mounted upon a base or frame composed of wood.

No artificial light is allowed to be used in any room, compartment or booth in which a motion-picture machine is installed except that produced by electricity. All electric wiring must be brought into the booth in iron conduits. One light will be allowed for each machine and one for the rewinding bench, but all such lights must be provided with wire guards, and reinforced cord must be used for pendant purposes. If house lights are controlled from within the booth, an additional emergency control must be provided near the main exit and kept at all times in good condition.

All electrical wiring or apparatus used in connection with any audience room or located in any room, compartment, booth or inclosure containing a motion-picture machine, or in which an exhibition is to be made, must be in full compliance with the rules of the National Electrical Code, and inspected and approved by the city electrician, or the chief of the fire department if there is no city electrician.

Truing Commutators.

Writing in a recent issue of *Power*, Fred Boone remarks that if the commutator on a direct-current dynamo or motor is kept properly trued by the use of sand paper on a curved block, or with any other good smoothing device, it should hardly ever be necessary to take the commutator to a turning lathe.

However, if the grinding apparatus is not properly made and used it will grind more on one side than the other, or grind in spots. In either case the trouble seems always to become worse with each grinding rather than better.

Two pieces of sandstone or grind rocks can be used where this sort of material is available. These should be chiseled out to fit and each piece should reach nearly half-way around the commutator, if possible. It is best to use two pieces in order to make certain that the pressure is exactly the same on both sides, and for the same reason best to grind while the armature is revolving at a fairly high speed.

An attempt to smooth a commutator by drawing the sandpaper back and forth on it while it is not turning is quite certain to throw it out of round and the use of a short block or stone will usually grind low spots; but a stone reaching one-third or more around the commutator will touch only the high places and automatically keep it ground to a true circle.

Where the commutator is quite large it is advisable to make the half circle with several stones clamped between two boards. The boards should be heavy and the bolts drawn up very tightly to prevent accident. The same stones may be used on two or more sides to fit the different circles and they may be rearranged in the clamp.

Annual Convention of Syracuse Contractors.

The Electrical Contractors' Association, of Syracuse (N. Y.), will meet in its next annual convention at Hotel Onondaga, Syracuse, January 21. Business of special importance to the members and to the trade in general will be taken up. The sessions will close with a banquet to members and guests, in the Hiawatha Room of the Hotel. It is hoped that every member of the association will attend all the meetings.

H. N. Smith is the president of the Syracuse Association, and C. C. Mackenzie is its secretary. The secretary reports a year of pleasing progress and says that the Syracuse organization is expecting even bigger progress in 1913.

THE INSPECTOR ENFORCED THE RULE.

By J. S. Colburn.

When an electrical contractor undertakes to do work in any particular town it is always exceedingly fortunate for him if he can secure a set of definite rules pointing out clearly and concisely the requirements of the local inspection department, where this department has requirements supplementing or differing in any way from the specifications of the National Electrical Code. The writer's experience, however, has led him to believe that there is no town whose municipal electrical inspection rules can always be followed to the letter. In fact, cases will arise in practice where there has to be slight deviations from the literal requirements of the National Code itself. No contractor should insist on such deviations, nor no in-

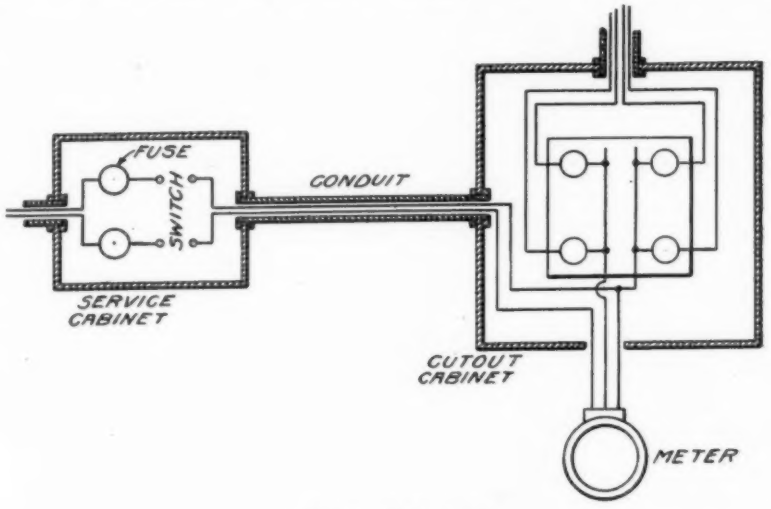


Fig. 1.—Original Job.

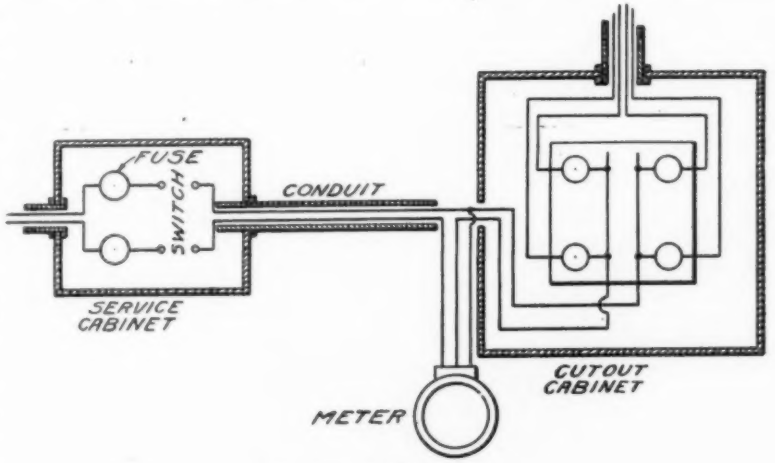


Fig. 2.—Job After Change.

spector permit them, unless they insure a higher grade of construction than would otherwise be possible. That they sometimes do cannot be denied, and the ability to appreciate this fact without falling into the error of allowing departures from the rules where they are not necessary nor excusable is one of the marks of proficiency in the inspector.

Not long ago the writer came across an installation where, it seemed to him, the inspector's devotion to the letter of the rules had been unusually unfortunate. The character of this installation is indicated below.

A contractor was wiring a small building in a town where the local rules required the service switch and the branch cut-outs in a building of the kind to be placed in separate cut-out cabinets. The contractor installed the two cabinets and connected them together with a short run of conduit. He carried the meter loop out through a knock-out hole in the bottom of the cabinet containing the branch fuse blocks, the meter loop wires being incased in fiber flexible tubing. A substantial board was installed just under the cabinet mentioned for the meter. In short, the completed job, with the meter in position, was as indicated roughly in Fig. 1.

On final inspection, however, the electrical inspector for the town reminded the contractor that there was a rule which specified that the meter must be located between the two cut-out cabinets, and refused to approve the job unless the location of the meter was changed to conform to this rule. After unsuccessful efforts to convince the inspector that a poorer job would result from the change, the contractor proceeded to move the meter into the desired location. He found that the adjacent sides of the two cabinets could be forced enough apart to pull one end of the conduit connecting them out of the hole in the side of the box. He had his men pull the end of the pipe out, and the meter was installed as indicated in Fig. 2. In this shape the job passed inspection.

The installation is exceedingly unsightly, and the service-switch cabinet is not grounded at all. Would not the first way of installing the work have been much better?

Among the Contractors.

Spence & Finn, electrical contractors of Altoona, Pa., have just finished wiring the new Eagle Building in Altoona, and the twenty new cottages, two bath houses and large stable of the Crescent Sanitarium at Crescent, Pa. Two other jobs recently completed were the new Somerset Hospital for the Insane, near Somerset, Pa., and the complete electrical equipment in the new Young Men's Christian Association Building at Hollidaysburg, Pa. Mr. Spence reports a highly satisfactory business extending over the last two years.

Fred B. Jackson, electrical contractor of Greensburg, Pa., has recently moved into larger quarters at 211 North Main Street, where, in addition to the contracting and supply business, a line of fixtures will be handled.

John S. Musser.

The gentleman about whom the following notes are written is known to a wide circle of personal friends and business associates as the genial and good-natured president of the Dauphin Electrical Supplies Company, of Harrisburg, Pa. Born 50 years ago in the town of Columbia, he received his

John S. Musser.

early education in the public and private schools of that town, and at the age of 12 years was apprenticed to his father in the furniture business. Here he soon became a thorough mechanic in this line.

After having attained his majority and having accumulated a few hundred dollars he decided to go west. In 1899 he moved to Aurora, Neb. Soon after reaching Aurora, in 1889, he availed himself of an opportunity to study law, taking a position as general assistant in a lawyer's office, where for two years he devoted himself industriously to the study of law. He was admitted to the bar and rose rapidly in his chosen profession. Financial reverses over which he had no control, however, caused him to make up his mind to return to his native state. He went back to Philadelphia in 1895, and not finding a desirable opening there as a lawyer he took up his early trade again and opened a small shop in that city. Here success attended his efforts, but after four years he found it necessary to give up business for a while in an effort to regain his health. He purchased a farm in Virginia and lived on it until 1903. Then he returned to Pennsylvania and secured a position as manager of the Arrowsmith Electrical Company in Harrisburg, this concern being one which maintained a chain of electrical stores and did electrical contracting in several towns.

Having no experience as an electrician, he took up the study of electrical subjects at odd hours, making full use of all available technical literature and of any other accessible source of the sort of information he was seeking. He filled his position so satisfactorily that when the Arrowsmith Electrical Company was sold to the Reading Hardware Company and the new owners decided to make the store one of the best in Harrisburg, Mr. Musser was commissioned to obtain the best location for a store and was given full authority in the matter of buying goods and fittings. Not long after this he formed a company which bought out this business, this being the Dauphin Electrical Supplies Company, of which he was made president. Under his able management the business has steadily prospered until the company is now maintaining both wholesale and retail departments of every sort of electrical merchandise, a large jobbing and contracting business and furnishing and installing electrical fixtures.

Mr. Musser says that from his early experience he learned three fundamental principles of business which have been of great value to him in his later years in the electrical field. These are that every mercantile transaction should show a profit to the seller, that every purchaser should receive full value for his money and that giving away merchandise for the sake of attracting customers or other advertising purposes is a practice which can be very easily abused.

Mr. Musser is a member of the Harrisburg Board of Trade, the Engineers' Society of Pennsylvania, the Merchants' Association, the Colonial Country Club, the National Electrical Contractors' Association, the Sons of Jove, the National Electric Light Association, the Electrical Contractors' Association of Pennsylvania and of several secret societies. He is also a director in the Harrisburg Rotary Club. His family consists of his wife and four children and his home is on the Susquehanna River in one of the most desirable residential sections of Harrisburg. He is energetic and serious in all business matters, but withal a good fellow, and a loyal and generous friend.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Magnetic Connectors.

Much annoyance may be avoided in the use of the connectors which wiremen use by magnetizing the handles of these. When this has been done, instead of slipping off every time the handles are gripped together tightly the latch will be held in position by magnetic attraction. Harry Strang.

A Handy Bit Extension.

Fig. 1 is a sketch of a bit extension which we find very useful. A piece of quarter-inch pipe (*a*) has a long thread on the outside of it, and is squared inside to fit bit shank. On this is screwed a three-eighths by one-quarter-inch coupling, and into the large end of the coupling is screwed a three-eighths-inch bushing which has been sawed in two lengthwise. Tightening the bushing forces the shank of the bit into the squared hole in the pipe. For the brace end, the shank of an old bit driven into another piece of quarter-inch pipe is used and as many short pieces of pipe are coupled between as are needed for the job.

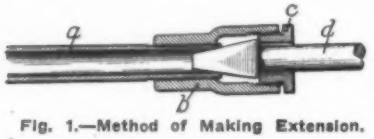


Fig. 1.—Method of Making Extension.

This tool will enable one to drill through all cross braces, etc., from one floor to the next without breaking walls. Edwin L. Ross.

Installing Sign Flashers.

I find that many electricians have trouble in installing an "on-and-off" flasher where low-voltage sign lamps are operated by means of a sign-lighting transformer. The trouble usually is that the flasher is placed on the wrong side of the transformer. For the on-and-off flashing effect, the flasher should be connected between the service and the transformer, or in the primary side of the transformer. Thus the amperage in the brushes of the flasher is reduced to a minimum. Connecting the flasher in the low-voltage side of the transformer places useless strain on it and greatly shortens its life. William Dower.

Tool for Raising Wires to Tops of Poles.

I was once called upon to put up 12 miles of transmission line, and was given two boys for linemen and one other helper who could not climb at all. After starting the work I found that neither of the boys was able to climb the poles and carry up the wires, and, since I had no time to do this work myself, I had to devise means for overcoming the difficulty. I designed what may be called a wire elevator, and set the helper just mentioned to operating it. The thing worked so well that I feel that a description of it is worth while.

I procured a light, strong pole which was long enough to reach from the ground to the tops of the line poles, and placed a spur in the bottom end of it, so that by jabbing the spur into the ground one could easily raise the pole. Then I fastened a small pulley at the top of this pole, and attached another one about two feet from the lower end of it. Around these pullies I placed a sash cord in such a way as to make an endless belt from top to bottom. The elevator was then completed by placing two wire hooks on the sash cord about a foot and a half apart.

In using this appliance, the helper would raise the pole, let the top rest between the cross-arm and the line pole, hook the field wire on the top hook and the road wire on the bottom one and raise the wires to the top by pulling down on the opposite side of the belt. The pole was next raised until the wires were above the cross-arm, and then lowered until the road wire unhooked in its place, after which it was easy enough to swing the other wire into place. The whole operation was much simpler and easier than is possible where a lineman has to climb poles and carry wires up them.

Harry Strang.

Design of Bell Circuits.

The diagrams which are shown here illustrate arrangements of bell circuits which I have found convenient. In the circuit shown in the upper one of the figures, only one battery is needed, and this may be connected as at *B*, one pole being grounded at *G*. When the push-button switch on the left is closed, the current flows from *B* through the right-hand bell, and back to the battery by way of grounds. The path of the current when the other switch is closed is easily traced.

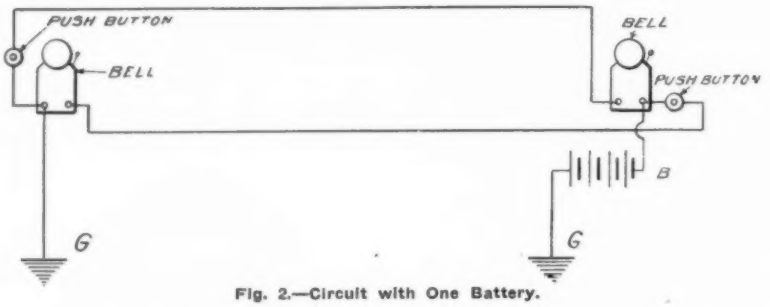


Fig. 2.—Circuit with One Battery.

In the case of the arrangement of circuits sketched in the lower one of the figures two batteries are needed. If the left-hand switch, say, is pushed, current flows from *B* through the bell on the right, and completes the circuit through the ground. Similarly for the other bell. George A. Hull.

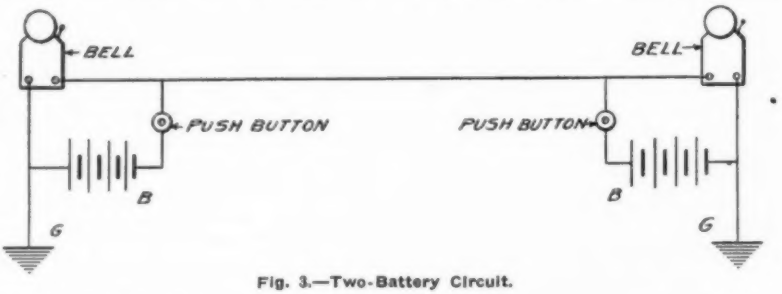


Fig. 3.—Two-Battery Circuit.

Information Wanted as to Joint Pole Line Ordinances.

C. S. Downs, city electrician of Altoona, Pa., would like to know the names of such cities as have a joint pole line municipal ordinances, or of any city requiring joint pole line construction.

Public Service Commissions

CALIFORNIA.

The city of Palo Alto, after voting the control of its utilities to the Railroad Commission, complained against the rates of the Palo Alto Gas & Electric Company. The defendant applied to the Superior Court of Santa Clara County for a writ of prohibition to prevent the Commission from proceeding to hear the case, contending that the city trustees of Palo Alto had already fixed the rate for the ensuing year and that the Railroad Commission could not act until the end of that year. The decision of the Superior Court sustained the Railroad Commission, enabling it to proceed with the hearing.

NEW YORK.

The Public Service Commission, Second District, has authorized the New York Telephone Company to put in effect January 1, 1913, new rates for general telephone service in Dunkirk city. The reductions in the annual rates will be: for business, direct line, $12; two-party line, $18, and for residence, direct line, $9; two-party line, $6; four-party line, $3. The rate for farmer lines served by such central office for residence service is reduced $3.

The Public Service Commission, Second District, has authorized the Rochester & Suburban Railway Company to exercise franchises granted by the town of Irondoquoit, Monroe County, for an additional track in, through and along the Ridge Road between Portland Avenue and Woodman Road, and upon and across Woodman Road at a point where Woodman Road and the Ridge Road intersect in the city of Rochester.

WASHINGTON.

The Public Service Commission will make to the next legislature the following recommendations for legislation:

(1) Under section 82 of the law, the Commission has power to suspend increased rates proposed by public service companies. A reasonable construction of this section would seem to impose the burden of proof upon the Commission to show that the increased rate is unreasonable. The Commission will recommend the adoption of the language of the federal Interstate Commerce Act in this connection, in which it is provided that the burden of proof to show that the increased rate is just and reasonable shall be upon the company. The Commission believes that all public service companies contemplating increased rates should establish before the Commission the necessity for such increase and the further fact that such increase is just and reasonable. Under our present law such burden of proof and such showing is not necessary—hence it will recommend the above amendment.

(2) Section 86 of the law with reference to appeals and writs of review is somewhat ambiguous. Under this section it is difficult to understand in what county appeals may be commenced. The Commission will recommend an amendment to this section to the effect that writs of review may be applied for in the superior court of the state of Washington in the county in which the hearing before the Commission has been held. In case the hearing is held in different counties then the superior court in the county in which the hearing was commenced and testimony taken should have jurisdiction.

(3) Under section 15 of the law no change can be made in any schedule of rates on file with the Commission except after thirty days' notice to the Commission and publication as by statute provided. Under section 81 of the law it is provided that the Commission's orders shall take effect twenty days after service thereof. Question has been raised whether, in case the Commission orders a change in the rates, rules, regulations or practices of a company, such order becomes effective, in view of the above section, in thirty days or in fifty days. In view of the apparent ambiguity the Commission will recommend an amendment providing that all Commission orders, whether changing published tariff rates, rules, regulation, practices, or otherwise, shall become operative and effective within twenty days, unless such time be extended by order of the Commission.

OHIO.

The Public Service Commission has authorized the Washington Gas and Electric Company, Washington, O., to distribute among its stockholders $50,000 procured from the sale of capital stock as reimbursement for moneys expended from income to make extensions and improvements.

WISCONSIN.

The Wisconsin Railroad Commission has ordered the New Glarus Electric Light and Water Company to discontinue the present flat-rate schedule and to establish a schedule based upon the cost of service. The new schedule will involve an increase in rates.

The Eastern Fond du Lac County Telephone Company has been authorized to increase its rate from $12 per telephone per year to $14. The Random Lake Telephone Company has been empowered to establish a new schedule of rates ranging from $18 per phone per year for single-party business service to $12 for rural service. The present rate is $10 per year.

Upon complaint of subscribers, the Matteson Telephone Company has been ordered to discontinue its present practice of giving rebates to those of its subscribers who own all or a portion of their telephone equipment, as it is contrary to the provisions of the public-utility law. The order provides for the payment by the utility of a rental to any subscriber owning a portion of the equipment, which rental is to be based upon a reasonable yearly allowance for interest and depreciation. In the investigation incident to the case, the Commission found that the present revenues were not sufficient to allow for a depreciation fund nor to provide a fair rate of return upon the investment. Although the question of rates was not raised by the utility, the Commission deemed it advisable to order an increase in rates ranging from 16 per cent in the case of local phones to 60 per cent in the case of rural phones. A rate of return of 7.5 per cent and a depreciation allowance of 6.5 per cent were used by the Commission in arriving at its conclusion.

The La Crosse Interurban Telephone Company has been authorized to issue $15,000 in 6-per-cent bonds to supply funds for the purchase of materials and making additions to the property, and $18,000 of preferred stock for the purpose of liquidating a like amount of outstanding indebtedness.

A Year's Progress in Continental Europe.

By C. L. Durand.

As regards the progress in central-station work on the Continent, we will first mention some of the principal enterprises in the way of hydraulic plants in the various countries. Switzerland is already making use of 750,000 horsepower, and the electrical industry is in a flourishing condition in that country, as nearly all the towns and villages are supplied with light and power at the present time. The hydraulic resources which are as yet unused amount to 500,000 horsepower, of which 125,000 horsepower are reserved for the federal railroads. A $40,000,000 project consists in using the power of the Rhine near Lake Constance. For the St. Gothard railway there will be erected several stations at a total cost of $15,000,000. In Germany it is expected to secure 100,000 horsepower from the Murg Valley, for the city of Stuttgart, and in Silesia there is a project for water storage on a large scale on the Oder and several other streams, involving the construction of six hydraulic plants. More than 20 barrages are to be built for this purpose. The principal interest in Norway centers in the Trolhättan plant, and this has now added two turbine units of 10,000 horsepower. When completed, the plant will have 80,000 horsepower in machines. An under-sea power cable is also projected for supplying Copenhagen from this station. Work is being carried on at the new Sammanger plant which is to deliver current to Bergen, and a number of others are building in that country and also in Sweden. In France the 300-mile power transmission scheme from the Rhone to Paris is likely to take practical shape before long, and this will give the city 300,000 horsepower. Austria is now active in this field, and it is expected to secure 150,000 horsepower for Vienna by extensive hydraulic work on the Danube, which will take three years to finish. A 12-mile canal will also serve for navigation and will supply 20 turbine groups in the station. St. Petersburg is another of the European capitals which is to use hydraulic power, and this will come from an extensive plant to be erected on the Vuokesen River so as to obtain 50,000 horsepower. The affair is being promoted by a Brussels syndicate, and probably other plants will be built on the same stream. Engineers are occupied with utilizing the waterpower of Iceland, and lately a French syndicate started an enterprise for building several plants in the mountainous region of the interior, where 200,000 horsepower will be obtained. The current will serve large electrolytic plants to be erected.

The use of steam turbines for central stations continues to make satisfactory progress, and at present the builders are increasing the size of the turbine units, as they are now running up as high as 20,000 to 25,000 horsepower. For instance, the Swiss Brown-Boveri firm is setting up a 25,000-horsepower group in the great St. Denis plant at Paris, which already had 100,000 horsepower installed and is, no doubt, the largest turbine station on this side of the water. An improved design allows of making such groups so as to occupy no more floor space than the 10,000-horsepower groups which are now used. The rotary part of turbine and alternator weighs 40 tons, and the outer part, 42 tons. Another large turbine, of 24,000 horsepower, is built by the Allgemeine Gesellschaft for the Chorzow station in Silesia. It works with a three-horsepower alternator. The Swiss Escher-Wyss firm also built a Zoelly turbine of about the same size for the Rhenish-Westphalia station at Essen, Germany, and it can even be momentarily loaded to 30,000 horsepower. It is stated that as much as 500,000 horsepower in Zoelly turbines has already been constructed. The rotor and shaft of the turbine itself weigh 30 tons, and it is coupled to a 65-ton Siemens-Schuckert alternator. The four bearings use 130 gallons of oil under pressure per minute. We also note that the Hamburg electric station is making an increase in the shape of a 6,000-horsepower steam turbine and three-phase alternator set. The Swiss Oerlikon firm, as well as the Augsburg-Nürnberg works, are manufacturing turbines.

The Diesel oil engine is meeting with great favor for central stations, especially in the smaller plants, owing to the compact shape of the groups and the use of crude-oil fuel. It is said that most of the small central stations in the towns of Denmark are operated by Diesel engines. Experiments are also being made with the use of fuels such as tar combined with paraffine oil, and this was done successfully by the Körting firm on a special 100-horsepower engine. Two new ones of 600 horsepower of a similar kind are being built. At St. Petersburg a new type of high-speed Diesel engine with outside air compression made a successful run, it being of 120 horsepower. We should also mention the Diesel engine built by the Augsburg-Nürnberg firm, of which there are many in use, among others an 800-horsepower engine installed in a Russian plant and a 400-horsepower engine in an Italian electric plant at Parma.

As concerns the electric traction field, one of the leading questions is that of the building or extension of city subways as well as the matter of handling suburban traffic. For instance, Paris is considering a very extensive scheme for running electric trains on the suburban railroads and the change-over will involve $30,000,000. A new motor car for this purpose is already being tried, and it carries two motors of 250 horsepower. It is desired to run frequent trains so as to be able to handle the heavy suburban traffic, and the St. Lazare depot will be remodeled for this purpose. On the other hand, work is progressing upon the extension of the city subways, according to the plans which call for 70 miles of lines. The new Hamburg city line is mostly elevated, but has about a quarter of its length (20 miles) in subway. It uses direct current with third rail at 800 volts. A special electric station was built for it on the three-phase high-tension system, and the cost of the work was about $10,000,000. Naples is one of the large cities which is to have a subway line. It will run across the city and connect with suburban electric roads. At Berlin it is planned to change over all the city and suburban steam railroads so as to run electric trains, and this work will be finished in 1916. At that date it is expected to handle 206,000,000 passengers per year on the Belt and 193,000,000 on the suburban lines, and the enterprise will cost $27,000,000. Electric locomotives will be used with the existing railroad cars. A large station is to be erected at a distance from town and a second plant will be located within the city limits. A syndicate of European capitalists was occupied with an extensive subway scheme for Constantinople, but at present it is not certain as to whether it can be carried out. An electric line of considerable interest is to be built from Rome to the coast at Ostia, and we should also mention the subway at Venice which will start from St. Mary's Place and run for two miles to the Lido, with a tunnel under the lagoons. Switzerland is occupied with the change-over of the entire federal railroad system, with the use of hydraulic plants to the extent of 120,000 horsepower. The Hötschberg electric railroad will start running next spring, and will connect with the Simplon. Its competitor, the St. Gothard line, is to be electrified in the near future, using 100,000 horsepower in hydraulic plants. We should mention the somewhat sensational project for a tunnel under the Channel so as to run electric trains di-

rect between London and Paris. The tunnel would cost $25,000,000.

Progress has been specially noteworthy in the field of wireless telegraphy during the present year. An event of interest was the international conference held at London, and it regulated many important points as to ship and shore messages. This year many of the leading countries are planning intercolonial connection by the use of stations all around the world. For instance, the French government is considering a scheme for encircling the globe, and transmitting from Paris to Dahomey and Madagascar in Africa, then across the Indian Ocean to Indo-China and over the Pacific across Panama to Martinique, then returning across the Atlantic and by way of Africa. Germany is engaged on connections across Africa for the colonies and Italy will connect with Tripoli and other places. A far-reaching enterprise is the British imperial wireless scheme which the Marconi firm is to carry out. Stations will be erected in the colonies so as to connect London with the Cape, also with Gibraltar, Alexandria, Bombay, China and Japan and give a round-the-world transmission. In France, the Eiffel Tower is now operating its new plant successfully, and there are nearly 20 coast stations working in the Atlantic and Mediterranean, also in Morocco and Algiers. New posts at Bordeaux, Nice, Timbuctoo, Annam, and Saigon will be erected. The Marconi company now has a chain of stations in the Mediterranean region, so that the Coltano station in Italy connects with the new Spanish plants at Aranjuez, Barcelona and Cadiz, also with the Canaries. The Coltano station connects with Canada at present. In Germany, the Nauen plant is being rebuilt since the great tower fell down, and this will now have a 650-foot height and cover 3,000 miles radius. Quite an extensive scheme is being carried out by the Marconi company, and it is erecting five stations in Bolivia, which form part of the chain connecting Bolivia, Chile and Argentina. An interesting event was the international time conference held at Paris and it was decided to organize a time service with Paris as a center and using nine stations all over the world so as to reach vessels on both hemispheres. We should not omit to mention the new Poulsen scheme for connecting Scandinavia and America by way of south Greenland. An English Poulsen company has been formed for connecting Ireland and Canada.

As regards telephone and telegraph matters, there is a satisfactory increase in the use of telephones in all the European countries. Stockholm appears to be in the lead as regards the number of telephones per capita, as there are 192 telephones in use per 1,000 inhabitants, followed by Copenhagen with 97, Christiania 69 and Berlin 60. Paris and London have but 28 subscribers. One of the principal enterprises of the year is the completion of the Paris central exchange, which was destroyed entirely by fire about four years ago and then used a temporary outfit. The handsome building is, no doubt, the most modern in Europe as to comfort and safety, and has two multiple boards of 10,000 subscribers each. The outfit will be completed by a third exchange board installed in another building. This plant serves for the central district, and the city also has a number of other exchanges throughout town. We should also mention the new telegraph connection board, which resembles the kind used in England and Belgium, and serves to give cross connection between towns having lines which center at Paris, so as to avoid retransmitting the messages. This will save 60,000 re-transmissions per day, and the board takes care of 50 telegraph lines. A new telephone line was opened up not long since between Paris and Vienna, by way of Innsbruck and Basel. Rapid telegraphy methods continue to occupy inventors, and one of the newest is the Pederson apparatus. It worked between Esberg and Lyngby in Denmark at 170 miles distance, then from Lyngby to Knockroe, Ireland, at 870 miles, and was said to record 300 words a minute on a paper strip. In France, attention is occupied with the Mercadier-Magunna multiple telegraph on the selective vibratory method, and it was successful in the Paris-Lyons tests. The use of Pupin cables in the Channel now allows the British provinces to telephone by way of Paris, which could not be done before, and London can now telephone direct to Geneva by way of Paris and Lyons, also to Basel and other points in Switzerland. The Italian government is making use of 20 miles of Pupin cable lately received from a British firm. The image-transmission problem is as far from solution this year as ever, in spite of sensational accounts and even photographs of apparatus which never worked, as a direct image has never as yet been sent over a wire, even in the laboratory. On the other hand, Dr. Korn's apparatus is working with success in sending photographs by using contact on a copper half-tone plate, and he now operates between Berlin, Paris and Monte Carlo. He is preparing to try it on the Atlantic cable for newspaper work and also across the American continent.

Electric iron and steel works are being erected on quite a large scale during the recent period, especially where water power is to be had. For this reason, Norway and Sweden are taking the lead in plants of this kind. In the region of the Trollhättan electric station there is being operated an electric blast furnace at Domnarfvet. A new steel works is to be erected by the Stavanger company and it will include rolling mills and steam-hammer plant. It is expected to turn out 1,500 tons of rolled steel annually. Another works will be installed near Arendal, and current comes from the Boilejos falls. The new Jankouter blast-furnace works is expected to produce 30 tons per day and now has a large plant employing 27 men. Another iron plant is the Hardanger works, which started up last year. The ore comes from the Klodeberg mine. It is reported that a new iron furnace, as well as a steel furnace, will be finished within a short time. The Tinfos iron works for the electrical smelting of iron will soon begin producing. In Germany, the Remschied-Hasten works is exclusively used for electric steel on the Lindberg process, and a new 25-ton furnace was lately put in which is said to be the largest in use. It works upon molten Thomas steel fed in from the outside steel plant and operates more cheaply than by the Siemens-Martin process. At Esch in Luxemburg there is being operated a large electric furnace mainly for ferro-manganese. An Austrian works is also engaged in erecting a Lindberg electric steel plant. Much interest is taken in the new Fischer process for electrolytic deposit of pure iron. Tests carried on in Germany showed that it can be obtained in 0.2-inch sheet and is almost in the pure state. Such iron has remarkable magnetic properties, with scarcely any hysteresis loss, so that it is good for dynamo and transformer work. An electric-furnace process is now used for ferro-silicon, and it is claimed that even pure silicon can be cheaply produced.

Suit to Be Started Against A. T. & T.

Announcement is made that early in the new year Attorney General Wickersham is expected to inaugurate a legal attack upon the American Telephone & Telegraph Company.

The American Telephone & Telegraph Company has been under investigation by the Department of Justice for some months. The reports of the special agents intrusted with the work are now before Mr. Wickersham and he is examining them for the purpose of starting litigation.

The company is to be subjected to a suit for its dissolution for violation of the Sherman anti-trust law, both in respect of its alleged suppression of competition and in its use of patents in restraint of trade. It is charged the combination has thrown business to the Western Union Telegraph Company at the expense of the Postal Telegraph Company. If the word "telegram" be given to the telephone operator, she at once connects with the Western Union.

Convention of Oregon Contractors.

The electrical contractors of the state of Oregon held their first annual convention on December 17 to 19, and by every one attending it was pronounced a great success. Electrical manufacturers, central-station representatives, electrical jobbers, electrical engineers, representatives of the National Fire Protection Association, city electricians, underwriters' inspectors and electrical lawyers, and electrical contractors, numbering 200 in all, attended this convention. The large assembly room of the Moose Hall was decorated for the occasion.

Joseph H. Ralston, of Albany, Ore., president of the state association, sounded the gavel. Gus Moser, the congenial, silver-tongued orator of Portland, with a speech most appropriate, welcomed the convention to the city of Portland. President Ralston responded to the welcome and explained how the state association of electrical contractors had been formed for the purpose of creating a closer fellowship among the electrical interests, and to develop the electrical industry in Oregon.

George H. Duffield, special representative of the National Electrical Contractors' Association, of Utica, N. Y., attended the convention on special invitation from the Oregon association. Mr. Duffield talked on the value of organization and the great good that results from concerted action of sincere and right-thinking men. He also explained what the national association was doing to benefit the electrical contractors throughout the United States, and how the officers were working to raise the business of electrical contracting to a higher plane. He also brought out how the National Electrical Contractors' Association is giving members something tangible as assets of membership, in the form of literature, information and data. Attention was called to the fact that in the progress of the electrical industry the national association was regarded by all other national organizations as a powerful factor.

F. D. Weber, inspector of the Underwriters' Equitable Rating Bureau, read a most interesting paper on "The Relation of the Oregon Electrical Contractor to the Underwriters' Inspection Work in Oregon." He pointed out many important facts, both as to what is being done by the inspection bureau and what should be done by the electrical contractors to give a higher grade of work.

F. N. Averill, manager of the Fobes Supply Company, read a valuable paper on "The Relation of the Electrical Jobber to the Electrical Contractor." This paper was heartily appreciated by the electrical contractors, inasmuch as Mr. Averill not only suggested, but said his company favored protecting financially the electrical contractors over the consumer.

O. B. Coldwell, general superintendent of the Power and Light Department of the Portland Railway, Light and Power Company, read a paper on "Some Practical Statements from a Central-Station Expert." Mr. Coldwell in his preliminary remarks said he did not class himself as an expert, and this committee gave him extreme honor in giving him that title, but it was apparent to all those who heard his paper that he is an expert.

Howard Joslyn, city electrician of Seattle, Wash., read a paper on "Municipal Inspection." He told of the electrical ordinance governing the city of Seattle.

L. B. Smith, manager of the credit department of Fleischner Mayer Company, made some very timely remarks on "Credit—Its Utility in the Modern Commercial World." His talk was historical, but valuable. He told how credit was the greatest asset to the individual's business.

R. G. Littler,
President of the Oregon Electrical Contractors' Association.

P. L. Procter, manager of the Pacific Audit Company, read a paper on "Costs and Efficiency," going over the contractor's business and pointing out the pitfalls. All of the papers were valuable to electrical men and this day of open session was considered one of education.

On the second day of the convention the Portland Railway Light & Power Company, in special electric cars, took the delegates and guests to the River Mill power plant. Then the happy crowd journeyed to the Estacada Hotel, where luncheon was served and J. E. Werlein acted as toastmaster of the occasion. He called on several of the visitors for extemporaneous talks. The party returned to Portland and in the convention hall of the Electric Building of the Portland Railway, Light & Power Company, the electrical contractors of the state held a business session, and elected officers for the coming year, as follows:

President, R. G. Littler, of Portland; vice-presidents, H. D. Lacken, of Portland; W. H. Baker, of Eugene; J. L. Vaughn, of Pendleton; and E. Dawson, of The Dalles; secretary, J. C. Green, of Portland; treasurer, J R. Tomlinson, of Portland; delegate to the national convention at Chattanooga, Tenn., R. G. Littler; executive committeeman, E. L. Knight, of Portland.

In the evening of the second day the banquet and entertainment was held at the Multnomah Hotel. In the beautiful ball room decorated for the occasion the feast was enjoyed. J. E. Werlein was the toastmaster and in his characteristic clever manner kept the guests in fine feeling throughout the evening. He called on many electrical men for talks. W. C. Bristol, dubbed "the human dynamo," electrified everybody with a wonderful talk. Gus Moser's talk was especially fine, as were those from the jobbers and manufacturers who responded to the toasts. Mr. Duffield gave an original poem on President Ralston and the Oregon Electrical Contractors' Association. W. T. Buchanan talked on "Coöperation."

One of the features of the banquet was the Oregon Electrical Contractors' double male quartet. This quartet carried the house with enthusiasm and certainly promised to command attention from the singing-loving public. It was made up as follows: tenors, Pierce, Keating, Altstock and McHoliand; baritones, Littler and McCartney; bassos, Tauscher and Ledberry.

The menu was as follows:

ELECTRICAL DINNER

Series
Six-Ampere Fuses in Shell
Assorted Locknuts Conduit
P and B Compound
Outlet Boxes with Knockouts
Salamoniac Cocktail
Armored Cable Circular Loom
Split Knobs
New-Code Wire Reinforced Cord
Soldering Paste
Plug Cutouts
Lamp Dip Friction Tape Condulets
Slow-Burning Wire Wet Batteries

A translation of these terms appeared on the reverse side.

This banquet was one of the most elaborate and interesting ever held in Portland. On the third day the Sons of Jove held a rejuvenation and admitted 40 wanderers to the fold, including several of the most prominent electrical men in Portland.

Praise of the work done by the different committees, especially the Portland electrical contractors who had the affair in charge, was general. The committees in charge were as follows:

Finance: Raymond G. Littler and Robert Skeen.

Program: W. H. Smith, J. C. English, Joseph Drouillatt.

Entertainment: J. C. English, W. H. Smith, Robt. Skeen, Samuel Jaggar, Raymond G. Littler, W. O. Fouch.

Publicity: John R. Tomlinson, J. H. Ralston.

Reception: Samuel Jaggar, Franklin C. Green, Charles P. Potter, J. E. Kilkenny, W. O. Fouch.

Auditing: Franklin C. Green, Charles P. Potter.

The electrical men in this section are so enthusiastic over the great amount of good which was received from this convention that already a movement is on foot to show the National Association of Electrical Contractors the advisibility of coming to Portland either in 1914 or 1915 with its annual convention. The business men of Portland are getting interested in this movement and will boost The Rose City for the annual convention of the national organization within the next two years.

Electricity in the Work of the War Department Signal Service.

The annual report of Brigadier-General James Allen, chief signal officer, War Department, which has been approved by Major-General Wood, chief of staff, and President Taft, contains much information that will be of interest to the electrical trades and professions. Three sections of it deal, respectively, with the operations of the Signal Corps in Alaska, the Philippines and the United States; electrical fire-control installations for coast defense; and radio-telegraphy. The report says, in part:

The Washington-Alaska military cable and telegraph system now embraces 2,621 miles of submarine cable, 1,064.5 miles of land lines, and 10 radio stations.

The cable system has satisfactorily handled the large volume of business sent over it, as have the land lines and radio stations. There has been no material change in the cable and land line mileage, and the number of interruptions were fewer than last year.

The total "this line" receipts during the year were $176,756.22, while "other line" receipts amounting to $29,792.10 were collected and turned over to commercial companies. Official messages to the value of $182,641.94 were handled.

One hundred and fifty miles of "deep-sea" type and 30 miles of "intermediate" type of cable have been purchased, with a view to replacing that portion of the cable between Seattle and Sitka which has shown signs of deterioration.

The Signal Corps radio stations in Alaska have rendered excellent service in maintaining communication when interruptions have rendered the land-line system inoperative as to any section.

During the year new 10-kilowatt sets of the latest quenched-spark type have been installed at Nome and Gibbon and a new station installed at Nulato, the equipment at the latter point being the 10-kilowatt set formerly used at Nome.

The installation of the new apparatus at Nome and Gibbon, together with the additional station at Nulato, completes a chain of radio stations across Alaska from the Canadian boundary to Norton Sound, which can be depended on to maintain communication when accidents interrupt communication on land lines.

The supply of qualified radio operators to maintain these stations in a high state of efficiency has been a very vexatious problem.

Radiotelegraph stations were maintained and operators furnished at Manila (improvised one-kilowatt), Corregidor Island (10-kilowatt), Grande Island (one-kilowatt), Carabao Island (one-eighth-kilowatt pack set), El Fraile Island (one-eighth-kilowatt pack set), Caballo Island (one-eighth kilowatt pack set), Fort William McKinley (three-fourths-kilowatt wagon set), and Iloilo (one-eighth-kilowatt pack set).

The operations of the Signal Corps in the United States during that year covered the management of military telegraph lines, the establishment of post telephone systems, the supplying of signal equipment to the Army and the Organized Militia, the installation of fire-control systems for coast defense, military aeronautics, the provision of fire-control systems for Field Artillery, enlisting and training of recruits in visual, electrical, and telephone matters, electrical and other experimental work, and active and suitable training in preparing the corps for war or other emergency.

Schools for the instruction and training of enlisted men of the Signal Corps were conducted at Fort Omaha, Nebr., and Fort Wood, N. Y. Signal Corps companies A, B, and H garrisoned Fort Omaha and Company G Fort Wood.

The course of instruction for enlisted men embraces the following subjects: Visual signaling, fundamental principles of electricity, telephony, telegraphy, radiotelegraphy, line construction work, and special instruction in telegraphic accounts and property accountability to prepare men for assignment to duty in Alaska.

Owing to its great and increasing importance in the Signal Corps much time is devoted to instruction in radiotelegraphy. The officers are given a thorough theoretical and laboratory course, and, in addition, much use is made of the field and station radio apparatus. The possession of a well-equipped three-kilowatt radio station, which communicates with Forts Omaha and Riley regularly and occasionally with more distant stations, furnished valuable means for instruction.

The Signal Corps operates three cable ships, the "Burnside," the "Joseph Henry," and the "Cyrus W. Field," which were actively engaged in laying and repairing submarine cables during the past fiscal year. The cable ship "Burnside" operates on the Pacific coast, and is intended primarily to maintain the Washington-Alaska cable system, but is also used to install and maintain fire-control cables on the western coast of the United States.

The cable ships "Joseph Henry" and "Cyrus W. Field" are used on the Atlantic coast to install and maintain submarine cables forming parts of the fire-control installations of the different Coast Artillery districts protecting the ports on the Atlantic Ocean.

During the fiscal year the "Joseph Henry" steamed 8,814 and the "Cyrus W. Field" 6,153 nautical miles. Five new cables were laid, seven recovered, two abandoned, and 26 repaired. The new cables were between Fort Pickens and Fort McRee, Fort Terry and Fort Michie, Fort Stark and Fort Constitution, Fort Levitt and Fort Williams, and Fort Slocum and New Rochelle.

The post telephone systems were extended and improved very materially. This included the placing under ground of central-battery systems at a number of points, and the rehabilitation and standardization of target-range systems. Fire-control installations for coast defense operating range-station batteries, magazines, searchlights and other component parts of the armament were made at a number of artillery districts and fortifications. During the fiscal year the Signal Corps placed 1,539 orders for material, and advertised for bids in 594 cases. The office operated under appropriations for the year of $781,546.42.

Union Pacific to Operate Wireless Stations.

The Union Pacific Railway has made application to the Department of Commerce and Labor at Washington, D. C., for a license to operate and maintain a wireless telegraph system along its lines. The company wishes to install a technical experiment station, and the Government is requested to give a permission for such a station, which, it is stated, will be the second of the kind in the country. Several other stations, it is announced, will be constructed when the license is issued.

Automobile Shows at New York and Chicago.

Eighty-eight American manufacturers of pleasure cars and sixty-eight manufacturers of commercial vehicles will display their latest models at the annual National Automobile Show, to be held in New York from January 11 to 25. The show will occupy the two largest exhibition buildings in the metropolis—the new Grand Central Palace and Madison Square Garden, which has housed each winter's automobile show since the first one was held there thirteen years ago. This winter's double-header will, for the first time in half a dozen years, be conducted under the management of a single organization—the Automobile Board of Trade—and double tickets admitting to both buildings will be sold for the customary single admission price.

The first week of the show, which opens on Saturday evening and closes the following Saturday night, will be devoted exclusively to passenger automobiles, motorcycles and motor-car parts and accessories. During the second week, from Monday afternoon to Saturday night, only motor vehicles for industrial, commercial, municipal and federal purposes will be displayed, together with parts, equipment and supplies.

Most of the accessory exhibits, of which there will be fully 300, will remain in place throughout the two weeks.

Eight different manufacturers of electric commercial vehicles will exhibit during the second week, their displays being grouped together for greater effectiveness in the Grand Central Palace. These makers are as follows: Atlantic Vehicle Company, New York; Baker Electric Vehicle Company, Cleveland; General Motors Truck Company, Pontiac, Mich.; General Vehicle Company, Long Island City, N. Y.; The Lansden Company, Newark, N. J.; M. & P. Electric Vehicle Company, Detroit; Ward Motor Vehicle Company, New York, and The Waverley Company, Indianapolis.

The M. & P. is a new make of 1,000 pounds capacity, suitable for delivery service, and is unique in having the motor hung from the frame over the front axle, with direct shaft-drive between the divided battery boxes to the countershaft. When light, 45 per cent of the weight is carried on the front wheels, and when loaded 40 per cent of the total weight is carried on the front and 60 per cent on the rear axle.

The Atlantic and GMC trucks were exhibited for the first time at last winter's show and are practically new makes that have only recently been put into actual commercial service. The former is of conventional design, the single motor suspended from the side members of the frame and driving to the countershaft by a Morse silent-chain inclosed in an oil-tight case. The Atlantic trucks are made in one-ton, two-ton, 3.5-ton and 5-ton capacities. All have the steering wheel and controller on the left side and underslung battery boxes that load from the side.

The chief distinguishing characteristic of the GMC electric is the location of the battery box above the frame, extending under the driver's seat and partially into the forward end of the body. It is made in various capacities up to five tons.

New improved models have been added to the older lines made by the General Vehicle, Baker, Waverley and Lansden companies. The Baker and Lansden companies now make models up to four tons capacity, while the G. V. and Waverley trucks are made in sizes up to five tons capacity. All make 1,000-pound delivery wagons and intermediate sizes also. The Ward, which has been in the general market only for a year or two, will be shown in one-half, one, two and four-ton capacities. Each size is adapted to receive bodies of any style in ten different lengths, suitable for any trade. The GMC and Lansden are also made in a variety of frame lengths and wheelbases. A new five-ton model has been added to the Waverley line, which embraces, at the other extreme of capacity, a 600-pound model for light delivery work. The motor in the five-tonner is hung under the extreme rear end of the frame and drives by a jointed shaft to the counter-shaft in the middle of the frame.

Aside from the electric vehicles themselves, visitors especially interested in electrical apparatus will find many gasoline pleasure cars and commercial vehicles equipped with electric engine starters, full equipment of electric lights and double systems of electric ignition. These systems embrace motor-generators, driven by the gasoline engine, and storage batteries from which current is used to drive the generator for starting the engine after it has stopped and also for operating the lights and for ignition purposes when for any reason the magneto is not in use.

Among the accessories will be found a great deal of electrical apparatus, from storage batteries for operating the largest trucks to electrically heated gloves that keep the hands warm when driving a motor car.

Motor trucks and delivery wagons of all kinds and sizes, and adapted to every line of business, will be exhibited to the number of 250 or more at the Thirteenth Annual National Automobile Show, to be held in Chicago next February. Preparations are well under way for the show, and more than sixty manufacturing companies have contracted for space already. It is expected that when the truck show opens on February 10 there will be fully ninety exhibitors of complete vehicles occupying all the main floor space in the Coliseum and First Regiment Armory. There will also be about 200 exhibitors of motor-car parts and sundries, completely filling the galleries.

The automobile exhibition is the only one that is large enough to more than fill the Coliseum building, and it fills both buildings for two weeks in succession, pleasure cars from February 1 to 8, and commercial cars from February 10 to 15.

This is only the third winter that motor trucks and delivery wagons have been shown separately, yet they will require as much space as the passenger cars. They will range from light delivery wagons of about 500 pounds capacity, suitable for laundries, florists, milliners and other retailers of light goods, to monster ten-ton trucks that can deliver 100 tons of coal a day. Any type of body can be fitted to the running gear of these machines, adapting them to all kinds of work, from fire extinguishing to applying hot tar to road surfaces or hauling dynamite or eggs.

There will be many entirely new models, as most of the manufacturers have brought out new ones during the year to supplement their former models of different capacity. There will also be a notable number of new makes never before exhibited. The industry has been growing so fast that there are today as many manufacturers of commercial motor vehicles as there are makers of pleasure cars.

The following manufacturers of electric vehicles will make exhibits at the Chicago shows:

Coliseum, Passenger Vehicles, February 1 to 8—Chicago Electric Motor Car Company, Church-Field Motor Company, Standard Electric Car Company, Studebaker Corporation.

First Regiment Armory—Anderson Electric Car Company, Argo Electric Vehicle Company, Baker Motor Vehicle Company, Borland-Grannis Company, Broc Electric Vehicle Company, Buffalo Electric Vehicle Company, Columbus Buggy Company, Ohio Electric Car Company, Rauch & Lang Carriage Company, Waverley Company, Woods Motor Vehicle Company.

Coliseum, Commercial Vehicles, February 10 to 15—Buffalo Electric Vehicle Company, General Motors

Truck Company, Walker Vehicle Company, Waverley Company.

First Regiment Armory—Baker Motor Vehicle Company, General Vehicle Company, Kentucky Wagon Manufacturing Company.

Second Annual Peoria Electrical Show.

It is stated at Peoria, Ill., that extensive plans have been made for a successful show which opens Saturday, January 18, and closes January 25. The success of the first annual electrical show held in January, 1912, in the Coliseum at Peoria, demonstrated that at least one of the smaller cities together with the populace of the surrounding territory is amply able to support such an exposition. The 1913 show will far surpass the one held in 1912.

An effort is being made to make this a gala week among electrical men. All central-station operators, contractors, dealers, architects, engineers, and telephone men in the Mississippi valley states are especially invited and will attend in force. Much special entertainment is being arranged for the electrical fraternity during the week, including the rejuvenation of the Sons of Jove, in charge of City Electrician W. E. Wolgamott, who has been appointed special statesman to assist in putting on the Rejuvenation Thursday evening, January 23.

The Illinois Electrical Contractors' Association will convene January 18, the day on which the shows opens. It has also been planned to hold the convention of the Illinois Independent Telephone Association. A liberal appropriation has been made for advertising. Some of the sectional and national trade journals carry the show announcements, also the Chicago, St. Louis and Peoria daily papers as well as daily papers in eleven other cities, and weekly papers in forty-three country towns. Space has been requisitioned in street cars and interurban cars. Bill boards are being liberally used all over the state of Illinois. Electric signs and searchlights on the big Coliseum will attract attention during the week as well as an especially illuminated "White Way" along North Adams Street leading from the center of the retail district to the Coliseum entrance.

Peoria has become far-famed as a convention city, fifty-nine national conventions having been secured for 1913. After the first show, it is said that every exhibitor went away well satisfied that he was repaid in the flood of orders that were there placed with him for his goods, and there seems to be not the slightest reason to doubt a repetition during the second show.

Leroy A. Mills, secretary of the Peoria Show Association, under whose auspices the exposition is given, states that he has received a number of requests from electrical men at a distance for reservation at the best hotels. It is well for anyone planning to spend the entire week in Peoria to requisition rooms in advance.

Arrangements have been made to publish the *"Electrical Show News"* in the Coliseum, the press to be operated during the hours the show is open.

It is planned to dedicate each of the seven days of the show to one of the prominent electrical men. The particular line of endeavor of these men will be featured on the day dedicated to them.

One of the spectacular features will be some new Thordarson apparatus, the exact nature of which has not been disclosed, but it is certain that this particular exhibit will attract much favorable attention.

Arrangements are about completed for exhibits of electric cow milkers, electric incubators and brooders, all of which will be new to many of the patrons of the show, but which are destined to have a prominent place in their respective lines in the future.

Several free feature entertainments will be given every day including a picture show, in which films of electric devices will be shown, special concert instrumental music and vocal music. There will also be a spectacular performer each day, this to be chosen from the headliners in vaudeville.

The following companies have arranged for representation:

Holophane Works, Cleveland, Ohio; Kinetic Engineering Company, Newark, N. J.; Central Telephone & Electric Company, St. Louis, Mo.; Pass & Seymour, Inc., Solvay, N. Y.; Chicago Fuse Manufacturing Company, Lindstrom-Smith Company, Western Electric Company, Apex Appliance Company, Pelouze Manufacturing Company, Automatic Electric Signal Company, William P. Crockett Company, Chicago, Ill.; International Correspondence Schools, Scranton, Pa.; C. S. Knowles, Boston, Mass.; Thordarson Manufacturing Company, Chicago, Ill.; American-Ever Ready Company, New York, N. Y.; *Electrical Review and Western Electrician, Popular Electricity*, Stromberg-Carlson Telephone Manufacturing Company, Telephone Improvement Company, Chicago, Ill.; S. H. Couch Company, Boston, Mass.; Peoria Gas & Electric Company, Mills Electric Company, Palmer Electric Company, C. E. Stapp Electric Company, Electrical Testing Company, Midget Cigar Company, Feoria, Ill.; Dalton Adding Machine Company, Poplar Bluff, Mo.; Charles C. Adams & Company, Peoria, Ill.; Detroit Electric Car Company, Detroit, Mich.; Sam Strubb, Clinton, Iowa.

BOOK REVIEWS.

"Electrical Injuries." By Charles A. Lauffer, M. D. New York: John Wiley & Sons. Cloth, 72 pages (4x6½ inches). Supplied by the Electrical Review Publishing Company for 50 cents.

This is a volume which should be in the hands of everyone who is engaged in work which exposes him to danger from any electrical circuit of high voltage to cause injury to the body. The subjects of burns and shocks by electricity are treated in concise and simple manner and yet fully enough to enable any intelligent person to apply the proper first aid to the injured. The manner in which injuries are caused is discussed and the proper treatment for burns, as well as the method of resuscitation of one shocked into insensibility is clearly stated. A series of questions at the end will serve to test the comprehension of the reader and show him whether he has assimilated the contents of the book. The author is the medical director of the Westinghouse Electric & Manufacturing Company and his experience with this subject has enabled him to treat it in an authoritative and practical manner.

"Wireless Course in Twenty Lessons." By S. Gernsback, A. Lescarboura and H. W. Secor. New York: The Electro Importing Company. Cloth, 160 pages (6x10 inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

This is a series of 20 lessons in wireless telegraphy, suited especially to the amateur without previous preparation on the subject. The introductory lessons take up the elementary principles of electricity and magnetism, the operation of generators and motors and the general principles of wireless telegraphy. The details of transmitting and receiving apparatus and aerial antennas are then considered at some length. The four concluding lessons are concerned with high-frequency current, the wireless telephone, the mathematics of wireless telegraphy and a history of the development of wireless telegraphy. The lesson on mathematical relations consists mainly in a statement of formulas and not sufficient explanatory matter is given to show the origin of these nor is the subject gone into very deeply on the mathematical side. The instructions for handling wireless apparatus go much into detail and the amateur who is setting up his outfit should find this course of instruction very helpful.

Marconi-Portugal Contract.

The Portuguese Government is to establish a chain of wireless stations connecting its island colonies with the mainland. The Marconi Wireless Telegraph Company, Limited, has just been advised of the ratification by Parliament of the contract entered

into with the Government of Portugal. Under the terms of this contract, the Marconi company is to receive 2,006,000 francs for erection of the wireless stations, which are to be located at Lisbon, Oporto, the Azores, Madeira and Cape Verde Islands.

Copper Production in Alaska.

Advance statements of the United States Geological Survey give the following interesting information respecting copper production in Alaska:

"It is estimated that the total value of the mineral output of Alaska in 1912 is $21,850,000, compared with $20,650,000 for 1911. The value of the gold output of 1912 is estimated at $16,650,000; that of 1911 was $16,853,256. It is estimated that the Alaska mines produced 28,940,000 pounds of copper in 1912, valued at about $4,630,000. In 1911 the output was 27,267,871 pounds, valued at $2,264,584. The silver production in 1912 is estimated to have a value of $300,000, as compared with $243,923 for 1911. The value of all other mineral products in 1912, including tin, marble, gypsum, coal, petroleum, etc., was about $260,000, compared with $176,942 in 1911. The total value of Alaska's mineral production since 1880, when mining first began, is, in round numbers, $229,000,000, of which $202,000,000 is represented by the value of the gold output. The total output of copper in Alaska since 1901 is about 90,000,000 pounds, valued at about $13,145,000.

"The increased copper production of 1912, compared with 1911, is to be credited to the Chitina and Prince William Sound districts. The rise in the price of copper led to much prospecting and deadwork in these, as well as in other districts.

"The Jumbo and Rush & Brown mines were the only considerable shippers of copper ore in the Ketchikan district. It appears that the Mount Andrew mine was idle for most of the year, but plans have been formulated for systematic development. Developments were continued on the It, the Red Wing, the Vittory and the Lhote & Sanford properties, and steps were taken looking to the reopening of the Copper Mountain mine. Some work was also done on a copper-bearing vein at Sum Dum, in the Juneau district.

"The Kennicott-Bonanza mine is the only one in the Kotsina-Chitina district from which shipments were made in 1912, but a large amount of development work was done on other properties. The concentrator installed in 1911 at the Bonanza mine was operated during 1912. At the east end of the field work was continued on the Mother Lode, Nikolai and Westover properties, and also on a property located on an island in the Kennicott Glacier. Prospecting and developing were especially active in the vicinity of Kuskulana River. Here the largest operations were those of the Great Northern Development Company, which completed about 5,000 feet of development work. The Alaska Consolidated Copper Company carried on development work on Nugget Creek and on the Rarus group of claims. The Alaska United Copper Exploration Company continued work on the Blackburn group of claims, located on Porcupine Creek. In addition to the above, a large number of claims were being opened in the Kuskulana region during the summer of 1912. This field is now readily accessible from the railway, and a branch has been surveyed which would permit the shipment of ore.

"On Prince William Sound shipments were made by the Ellamar Mining Company, the Threeman Mining Company, the Landlocked Bay Copper Mining Company and the Beatson Copper Company, located on Latouche Island. In addition to productive properties, there were a large number of claims on which development work was carried on, some of which give promise of soon reaching a shipping stage. A notable advance was that made on the Solomon Gulch property, near Valdez, where a force of men was engaged during the year in opening a chalcopyrite ore body.

"But little advance was made in copper prospecting in those inland districts which are far from transportation. About 25 men are said to be carrying on prospecting and assessment work in the White River region, and there are also some in the Nabesna district. Prospectors report the finding of copper ore on Sheep Mountain, in the Matanuska Valley. Some copper ore has also been found on a tributary of the McLaren River, in the headwater region of the Susitna. A little development work was also continued on the copper prospects of the Iliamna region, in Southwestern Alaska.

The Annual Meeting of the Illuminating Engineering Society.

On the evening of January 10 the annual meeting of the Illuminating Engineering Society will be held at the Aldine Club in the Fifth Avenue Building, Twenty-Third Street and Fifth Avenue, New York City. The meeting proper will be preceded by an informal dinner to be served at 6:30 o'clock. The business meeting will begin about 8 p. m. The results of the election of officers and of the letter ballot on the constitutional amendments will be announced. Addresses will be made by some of the retiring and incoming officers and by others interested in the Society's welfare.

Distillation by Electrical Heat.

The application of electrical heating for the fractional distillation of wood tar has been described by H. K. Benson in *Metallurgical and Chemical Engineering*. In heating a retort by gas the distribution of heat is not at all uniform. Excessive local heating is produced, causing the decomposition of the heavy oils, the formation of noncondensable gases and an increased yield of coke residue. To overcome these difficulties an apparatus was designed with the following ends in view: (1) application of heat where most needed; (2) uniformity of heat; (3) absolute control; (4) elimination of bumping; (5) utilization of all the heat; (6) uniform quality of fractions.

In the design of the apparatus which finally proved satisfactory, the heat is applied by passing a current through nichrome wire wound around a distilling flask. The insulating material used is a mixture of two parts of infusorial earth and one part plastic blue clay.

Wires from two sections of the winding were connected in parallel, making a combined resistance of 13.3 ohms at 24 degrees centigrade.

A discussion of the cost for this work when using electricity and gas is made and it is shown that with gas at 70 cents per thousand cubic feet and electrical energy at one cent per kilowatt-hour, the relative cost is 1.12 for gas as against 0.4 for electricity. It was found that 15 cubic feet of gas distilled the same quantity of tar as 370 watt-hours. The cost per unit for electrical energy is placed low in view of the fact that a load of this nature would be a very desirable one, since it could be run either throughout the 24 hours or merely as an off-peak load.

The general conclusion reached is that distillation of wood tar by heat from electricity will yield a larger quantity and a higher grade of oils than by heat from flames. The cost is less than where gas is used as a fuel and control is easier and more certain. The absence of danger from fire is another advantage.

High-Speed Turbo-Alternators.

The 279th meeting of the American Institute of Electrical Engineers will be held in New York, January 10, 1913, in the Auditorium of the Engineering Societies Building, at 8:15 p. m.

The meeting will be held under the auspices of the Power Station Committee, and a paper will be presented by B. G. Lamme entitled "High-Speed Turbo-Alternators—Designs and Limitations."

New Electrical and Mechanical Appliances

New Domestic Electric Water Heater.

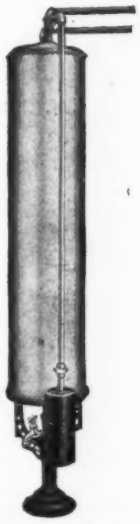
The rapidly increasing popularity of electrically heated household utensils has created a demand for an electric heater that can supply considerable quantities of hot water for general purposes, much after the fashion of gas heaters connected with the usual 30 or 40-gallon kitchen boilers.

The new General Electric circulation water heater is a small attachment piped outside of the tank, the water circulating naturally from the bottom of the tank through the heater and up to the top of the tank. The size of the pipe used, that is, the degree of restriction to the circulation, regulates the temperature of the water leaving the heater. This water naturally accumulates first in the top of the tank until gradually the whole tank becomes heated, but hot water may be drawn off the top from the start.

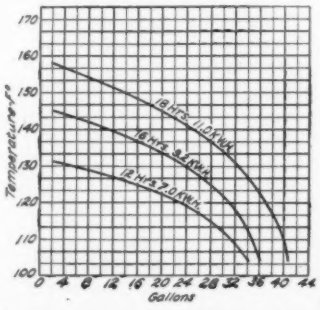
A heater consists of a hollow, closed cast-iron cylinder, with a hole at the top and one at the side for the water-pipe connection, and one in the bottom for the heating unit. A dead-end steel tube, inserted through the bottom hole and welded fast, provides a receptacle for the heating unit. From this the unit can be readily removed by unscrewing the porcelain terminal block.

This device is furnished in 600, 1,000 and 2,000-watt capacities, and can be used intermittently, or left continually in the circuit. When used intermittently the 2,000-watt size is recommended, while the 600-watt size is most suitable for continuous service.

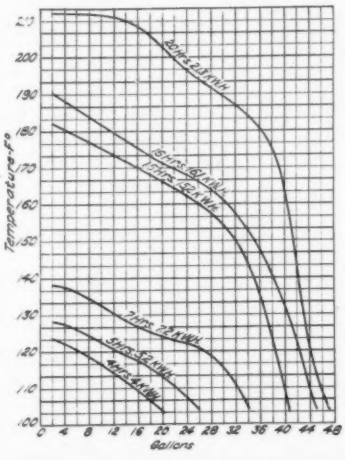
To prevent the water from cooling rapidly, and thus increase the efficiency of the heater, it is good practice to cover the tank with magnesia or asbestos slabs two inches thick, also applying a thin layer of magnesia cement to fill up the cracks between the slabs. If desired, hair felt, two inches thick, may be used in place of the magnesia. Over this a canvas covering should be placed, which may be either sewed together or glued. The pipes should be covered with standard pipe covering. This heater will operate either on alternating currents or direct current and is designed for potentials of 100 and 250 volts. It can be installed for service with any tank already in use. The curves herewith are plotted from the results of tests made with heaters of the different capacities operated in connection with a 40-gallon tank. These curves show the temperature of each succeeding gallon of water drawn off after the heaters have been in operation for the various periods of time stated on the curves, and they are based on the assumption that the water enters the tank at 50 degrees Fahrenheit and that the tank has a thermal insulation of two inches of hair felt.



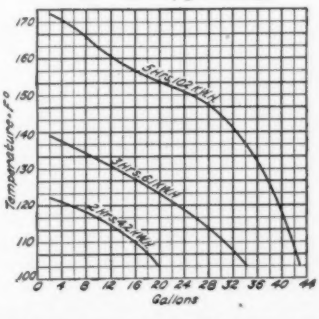
Circulation Water Heater.



Temperature Curves for 600-Watt Heater.



Temperature Curves for 1,000-Watt Heater.



Temperature Curves for 2,000-Watt Heater.

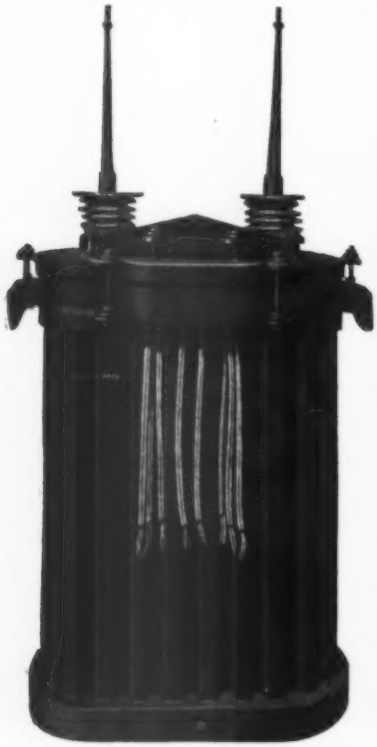
High-Voltage Pole-Type Transformers.

The mian difficulty encountered in the operation of transformers outdoors on high-voltage transmission lines is the problem of protecting the windings against the surges of abnormally high potential that are always in evidence to a greater or less extent on all transmission circuits. The Kuhlman Electric Company, of Elkhart, Ind., has just placed a new type of outdoor transformer on the market that is designed to cope with the conditions that exist without the need of a substation or expensive protective devices; they are designed to be hung on a pole, in the same manner as the ordinary distributing transformer, with simple and inexpensive protective devices, making the total investment sufficiently low to enable central stations to serve isolated customers with profit.

This transformer is given ample case room or space factor with a large body of oil entirely submerging all exposed parts of the electric circuit. The primary, or high-potential, windings are

subdivided into a number of coils, the actual number depending upon the voltage of the circuit for which it is designed; by this means internal strain between parts is reduced to a minimum. At the top of each leg of the core is provided a special terminal coil having comparatively few turns and very heavily insulated; these are a part of the transformer windings under normal operating conditions, but on account of their location and construction become effective closed-magnetic-circuit reactance coils during moments of surge, greatly retarding, if not completely preventing, dangerous voltage from getting into the body of the windings.

From these coils the terminals issue directly upward through the top of the transformer, without bends or kinks; the terminals proper consist of brass rod heavily insulated. This terminal projects 6 to 8 inches below the surface of the oil inside the transformer and some 12 to 14 inches outside and is secured in a special corrugated bushing securely leaded in place. The arrangement of the hanger iron is also unique, in that when the transformer is in position the top of this iron and the terminals are all above the cross-arm support, thus there is plenty of space factor both inside and outside the case. Properly treated oil is put into the transformer before shipment and the transformer made practically airtight so that no difficulties are encountered in installing.



Kuhlman High-Voltage Pole Transformer.

Compensation taps are provided on the primary where these are specified or required, but these are located well within the windings, usually in the second coil from the top; these are simply a means for cutting out a portion of the windings, by means of studs and links all located well below the oil level.

All coils are treated by the vacuum drying and impregnating process, all moisture removed and the coils impregnated with a non-hygroscopic compound insoluble in oil; this, in addition to providing added insulation strength, holds everything firmly in position, preventing mechanical displacements that are so certain to cause electrical troubles.

These transformers, with necessary modifications, according to voltage, can be built and operated successfully for voltages as high as 33,000. Some transformers of this type have been in service for over a year and have given uniformly good results. The design had been thoroughly tried out aud the manufacturer's conclusions are that, if care be taken in installing, a good horn-gap lightning arrester provided and connected to a good low-resistance ground, there will be no more danger of interrupted service from one of these transformers than is usual or possible with an ordinary service transformer.

The Clement Electric Service Table.

In connection with the Christmas doll and toy fund collected annually by the New Orleans *Times-Democrat*, an interesting innovation this year was the donation of an assortment of electrical household utensils obtained through the energy of W. E. Clement, of the New Orleans Railway & Light Company, and the assistance of James A. Ross and A. M. Andrews. The equipment represented a total value of about $500 which was turned over to the fund when the articles had been disposed of. A view of the equipment as it was displayed in the window of a prominent store is shown herewith.

The center of the display was the Clement electric service table, a description of which was given in these columns in the issue of August 31, 1912. In connection with this useful appliance, Mr. Clement, its inventor, has advised us that its possibilities are far greater than when he first developed it. The service table is a compact but complete electrical installation including meter, cutouts, switches and four sockets or outlets so located as to be available for immediate use for the attachment of any household electric lamp, heating utensil or motor appliance. It is intended primarily for affording to those householders or tenants in unwired houses an opportunity to enjoy the use of electric light and appliances without the expense of complete wiring of the premises. In New Orleans it has been found that the cost of running the central-station company's service wires to the service table is very low indeed. The service table then becomes the electrical center and from it branch circuits and extensions can be subsequently run in concealed wiring as the desirability of more complete electric service becomes manifest to the

Clement Service Table and Other Electric Appliances Donated to Doll and Toy Fund.

occupant. It thus acts as an entering wedge and sometimes leads to the complete electrical equipment of the house.

In the large cities of the East and Central West the percentage of houses wired runs from 4 to 30 per cent, with one notable exception of 40 per cent; in New Orleans it is about 11 per cent. Much difficulty has been experienced in getting old houses wired because the owner considers the expense too great. This difficulty is overcome by such a device as the Clement service table which can be installed at a minimum cost for wiring because the shortest possible connection to the central-station lines is made. What wiring is put in is run in strict accordance with modern practice. The meter and cut-outs are in a neat steel cabinet at one end of the table, thus avoiding the objection of unsightly appearance in the living room.

The Clement table is installed in New Orleans houses complete with wiring for only $17.50. This low cost should appeal to anyone who has hitherto resisted all efforts expended to induce him to wire his house. The desire for an electric fan is very keen in the South and for other electric utensils in other parts of the country. It is natural to suppose, therefore, that by means of the service table this desire will be easily satisfied and that this opportunity will appeal to the central stations as well as manufacturers of electrical appliances.

Mr. Clement has turned over the manufacture, sale and installation of the Clement electric service table to the Electrical Development Company, of New Orleans, La.

Telephones on the Gulf, Florida & Alabama Railway.

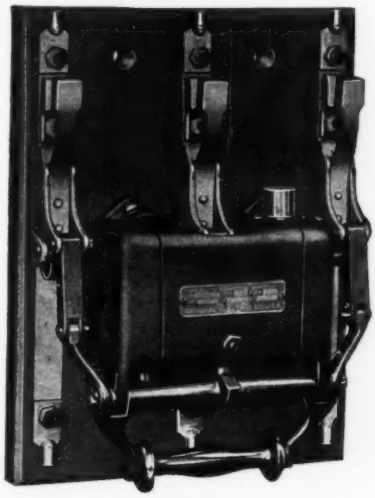
A new railway system, the Gulf, Florida & Alabama, which is an outgrowth of a railroad originally used by a large timber company and now converted into a standard-gauge road, is to be equipped with telephones for dispatching its trains. In furtherance of this plan, an order for the necessary apparatus has been placed with the Western Electric Company.

Fifteen way stations are to be equipped with No. 102-B selector sets, which contain the standard Western Electric No. 50 type selector, while the talking apparatus will consist of head receivers and chest transmitters. There are also to be 15 siding telephones of the No. 1317 magneto type installed along the right of way. Several portable train sets will be used.

The train-dispatching circuit will be about 90 miles in length, extending from West Pensacola, Fla., to Local, Ala. The dispatcher will be located at Pensacola.

Distant Control of Small-Capacity Power and Lighting Circuits.

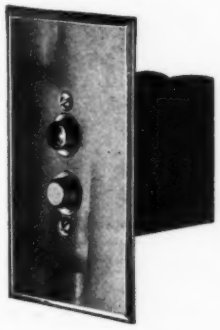
A lighting company furnishing power on a flat-rate basis for the operation of signs received numerous complaints when the current was turned off by hand owing to the attendant's inability to be at all the places at one and the same time so as to switch the current off all signs simultaneously. The complaints disappeared when the current



Triple-Pole Remote-Control Switch.

was cut off by remote-control switches all tripped simultaneously by the throw of a switch at the station.

Such a distant-control switch has a wide field of application. The one shown in the illustration herewith is substantially built and has few operating parts and, therefore, is suitable for installation at remote points where



Special Push-Button Switch.

it may not receive a very great amount of attention.

The switch is operated by a double-coil solenoid, one coil for closing and one for opening, controlled by a special double-push-button switch which is normally in the open position and remains closed only while it is held by the operator. To open or close the switch the corresponding push-button has to be pushed in. One of these switches is furnished with each remote-control switch and must always be used, as the solenoid coils are not designed to conduct their exciting current continuously. The cores of the operating solenoids are connected directly to the operating lever, which in turn is connected to the poles of the switch through a toggle mechanism. When a coil of the solenoid is energized, its core moves the operating lever up or down, forcing the switch closed or opening it, whichever action corresponds to the coil energized. The switch can be operated by hand, also, a handle being provided for this purpose and seen at the lower part of the switch.

This switch is a self-contained unit with two sets of contacts, the main contacts being laminated copper brushes, while the auxiliary ones, on which the arc breaks on opening the circuit, are of carbon. The main contact brushes are so constructed that each lamination makes an end-on contact without any tendency to force the laminations apart. The laminations have a wiping effect in closing, thus keeping the contact surfaces bright, and ensuring good contact always. The carbon auxiliary contacts are made of blocks of selected carbon fastened on without screws or bolts to ensure long life and satisfactory service.

The standard finish of all the live parts of the switch is polished copper, while that of the mechanism is dead-black marine.

The switch is made single, double or triple pole, single throw for service on alternating-current and direct-current circuits for potentials of 110, 125, 220 and 250 volts, and can be furnished up to 300 amperes capacity.

Besides the service mentioned above it can be used to open or close power or lighting circuits of comparatively small capacity at some distant point. It is also used in office buildings, libraries and public buildings, being installed in the supply circuits of cabinet panels and controlled from any desired point.

The cabinet panels in the Prudential Building, Newark, N. J., are thus equipped. Some other notable buildings provided with them are the Bankers' Trust Building and the Mercantile Trust Building, both of New York City, and the Educational Building, Albany, N. Y.

The switch described above is manufactured by the General Electric Company, of Schenectady, N. Y.

Exports of Copper.

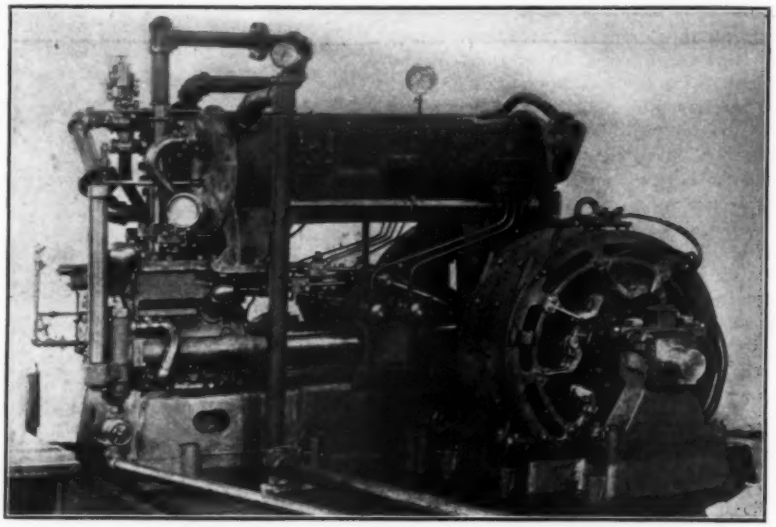
Exports of copper for the week ended December 26 totaled 6,277 tons; since December 1, 23,946 tons; same period last year, 30,752 tons.

Campbell Eight-Day Time Switches.

The accompanying phantom illustration of the Campbell eight-day time switch gives a good idea of the assembly and mechanical characteristics of this device. The clock movement is of an improved design extremely powerful, and is backed by the company's guarantee, as it is made in its own factory. The switch-operating mechanism, the trip levers, clock dial, the gear train and escapements are all made of extra substantial proportions to withstand long service and severe conditions. These switches are used for controlling lamps in suburban districts, for turning on and off lamps in electric signs, window lights, corridor lights in apartment houses, alley lights, and part-time lighting stores.

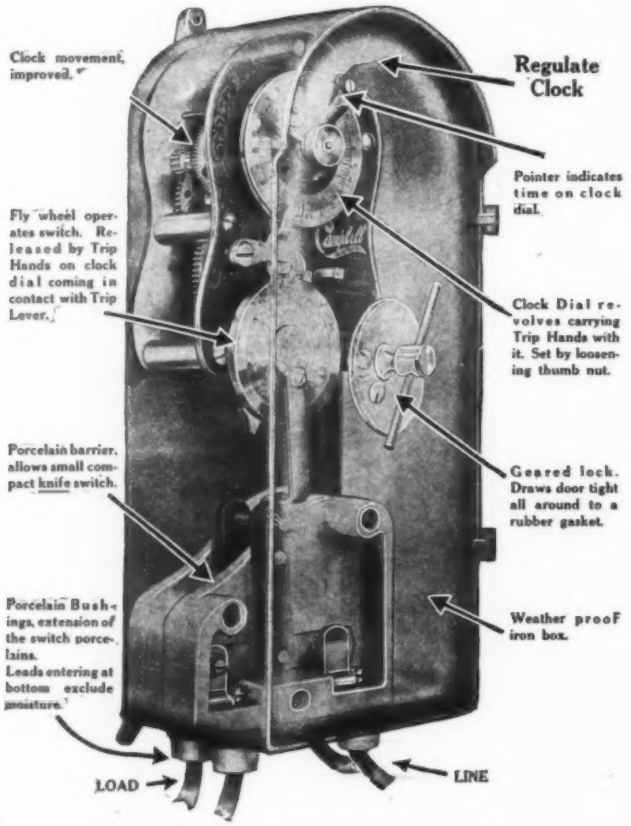
The eight-day switches are made in the following styles: Type "C," for ordinary installations such as store windows, signs, entrances, multiple street lights, storage-battery recharging; type "E" (high-tension oil break), for series street lights and transformer primary circuits; type "F" (double-throw for two-rate meter service); types "J" and "K" (multi-circuit), for house corridors, ornamental post lights, etc.

Any of these eight-day switches may be furnished with magnet release for remote control instead of clock, if desired. With this attachment battery wires may be run and push buttons located so that power may be controlled at will from many points.



Allen Motor-Driven Refrigerating Machine.

The Campbell Electric Company, Lynn, Mass., the manufacturer of these switches, also makes a one-day time switch designed to meet the demand for low-priced reliable time switches of capacities up to and including 35 amperes, triple-pole, 250 volts, to be used in places where it is convenient to wind and set the clock and switch each day. These switches are finished in polished nickel and equipped with an approved indicating switch inclosed in a cast-iron box of suitable construction.


Clock movement, improved.
Regulate Clock
Pointer indicates time on clock dial.
Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.
Clock Dial revolves carrying Trip Hands with it. Set by loosening thumb nut.
Porcelain barrier, allows small compact knife switch.
Geared lock. Draws door tight all around to a rubber gasket.
Porcelain Bushings, extension of the switch porcelains. Leads entering at bottom exclude moisture.
Weather proof iron box.
LOAD
LINE

Phantom Diagram of Campbell Time Switch.

Electrically Driven Allen Dense-Air Refrigerating Machine.

The central group of powder magazines on the United States Battleships *Delaware* and *North Dakota*, which are located between the boiler room and engine room, far below the water line, have required much artificial cooling in the tropical waters where our Navy frequently cruises. At the same time the presence of a steam engine, with its attendant steam pipes, increases the heat.

H. B. Roelker, of 41 Maiden Lane, New York City, the maker since many years of the Allen dense-air ice machine, therefore proposed to the Navy Department to build at his own cost and risk, a thoroughly satisfactory electrically driven Allen dense-air machine, which would do the required work, if the Department would provide its regular inspection, as done for its usual naval work, while the machine was building and test it after it was completed and also test it on a ship, if found satisfactorily operating at the shop test.

The Navy Department agreed and Mr. Roelker, in combination with the Diehl Manufacturing Company, of Elizabethport, N. J., built one of his three-ton machines, driven by a 120-volt, 50-horsepower Diehl motor coupled directly to the ice-machine crankshaft. It worked perfectly at the shop tests, and was placed on the

U. S. S. *Delaware*, cooling those troublesome midship magazines.

After six months continuous tests, mainly at the Guantanamo naval drill grounds, a report was sent that the machine was thoroughly satisfactory, and Mr. Roelker was requested to send in his bill. The illustration herewith shows the machine which did that work.

Street Lighting Supplied From Steel-Taped Cables Underground.

Success in present-day engineering is measured not alone by strength and efficiency, for beauty is at last recognized as a most essential element of the accepted design. Bridges and structures heretofore deemed satisfactory, if strong and serviceable, now create a storm of protest if the element of beauty is lacking. Likewise the appearance of streets and boulevards is receiving a share of that attention which was formerly devoted to convenience and durability. Only a few years ago our cities were in a maze of overhead wiring, but now the wires have been generally placed underground in the larger communities; the smaller places, however, have been seriously hampered in their efforts to follow this praiseworthy practice because of the considerable cost of conduit construction for underground systems.

Laying Steel-Taped Cable at St. Charles, Ill.

With the advent of steel-taped cable the way has been cleared for further progress along this line. Briefly, the steel-taped cable provides, in many places, a fair substitute for the underground conduit system at a lower cost. Its purpose is not to displace underground conductors in ducts where a very substantial, permanent and yet flexible system and provision for suitable future growth are necessary, but rather to fill a particular need for which the conduit system is either not required or not so well adapted, because of limited appropriation for the work. This field includes the smaller cities, suburban districts, parks, private estates and manufacturing plants where street and road excavations are not frequent, local conditions do not justify the greater expense of a conduit system and where flexibility is unnecessary.

Western cities are considerably in advance in the installation of such underground systems. Lansing, Mich.; St. Charles, Ill.; Wausau, Wis.; Austin, Tex., and Warren, O., are among those which have used steel-taped cable in their ornamental street-lighting systems. Kendallville, Ind., and Henderson, Ky., have employed it in connection with the decorative lighting of their public parks. These cities have used a regular lead-covered cable served with jute and tar, over which are two winds of steel tape in reverse directions, with still an overall serving of jute and tar, as manufactured by the Simplex Electrical Company.

The experience of these cities has shown a material saving in initial cost, due not only to eliminating the cost of duct material, but to the difference in the time and labor of constructing a conduit system and drawing in the regular lead-covered cable in the ducts over the installation of the steel-taped cable, since the latter is merely laid in a narrow and shallow trench and the earth replaced. The service record of this ready-made cable system has been so satisfactory as to give assurance of its complete success in the work for which it has been so appropriately adopted.

New Cutler-Hammer Three-Heat Cord Switch.

There are many electric heating devices now on the market that are designed to operate at several "heats." Such devices as electric water urns, chafing dishes, heating pads, frying pans, table stoves, tailor's irons, etc., are advantageously operated at a low heat, medium heat and high heat. For the convenient control of these devices the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has augmented its line of feed-through or cord switches by the addition of a three-heat brass-shell type as shown in the accompanying illustration. This switch can be placed on the cord in the most convenient location for operation.

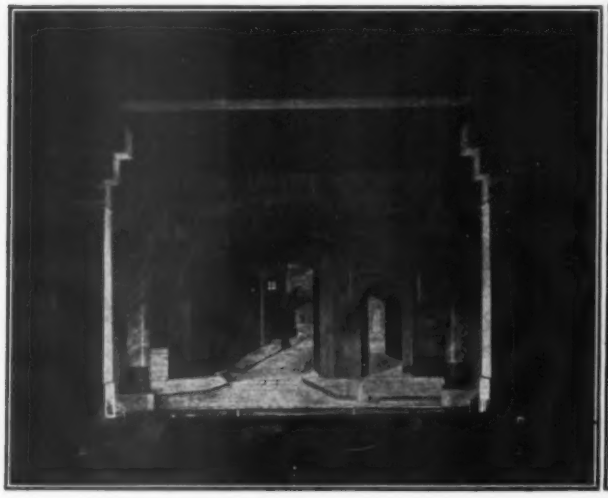
There are two push-bars, each having a light and black button, which operate twin mechanisms so arranged that the pushing of one light button gives low heat, while the other, operated alone, gives medium heat. The shell is plainly marked so that the operator may know which button to press for low and which for medium heat. To get high heat both buttons are pushed. The operation is positive and snappy, and one hand only is needed for the manipulation of the push-buttons. As can be seen from the illustration, two-conductor cord is required to connect to the socket or receptacle and three-conductor cord is needed to connect the switch to the heating devices. The brass shell is finished in polished nickel like the single-pole cord switch, No. 7040. The rating of the new three-heat switch, which is known as No. 7044, is 6 amperes, 125 volts, or 3 amperes, 250 volts.

Three-Heat Cord Switch.

An Interesting Theater-Lighting Equipment.

A very interesting lighting equipment has been installed in the Placade Theater, Huntington, W. Va., by the McKellar Electric Company, of Huntington. The auditorium is lighted from the ceiling by three domes. Each dome consists of 40 forty-watt tungsten lamps. In addition to the white lights in each dome there are 10 blue and 10 red lights. The lights work through dimmers. The red and blue lights gradually dim out the white lights. Just before the white lights are dimmed the operator throws in the red and finishes dimming the whites. This leaves the red lights about half dimmed. At this stage the operator throws in the blue lights, thus giving a purple glow and gradually dims out the reds leaving the sky of pure blue. Twelve stars are located in the sky canopy, and when the sky becomes blue these stars are thrown on and the blue lights are then dimmed out, leaving the canopy perfectly dark with only the stars lighted. Those who have seen this display state that it is one of the most beautiful electrical effects that has ever been witnessed. The house has been operated for several months, and this display is carried out before the first act and always arouses a fine response from the audience.

From an electrical installation point of view this equipment has some unique features. Under the balcony there are concealed on each side of the beams 15 lights. The footlights may easily be seen from the illustrations shown herewith. Bonnell Adaptiboxes were used, 6,300 fittings, of different types, meeting all requirements. The contractors state that in this case a saving of about 25 per cent on the labor was involved. This type of fitting facilitates rapid work, which was necessary in carrying out the installation. The three border lights are made up of these fittings, consisting of 50 lights in each border. In every instance the fittings met the requirements in all particulars and the contractors have been highly pleased with the working out of the installation.

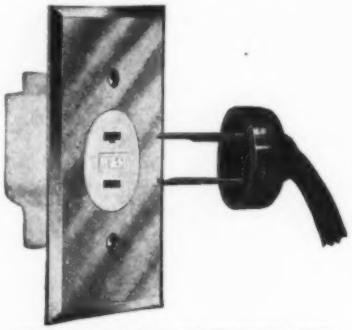


Stage of the Placade Theater.

Auditorium of Placade Theater.

Interchangeable-Plug Flush Receptacle.

The Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., has placed on the market a plug flush receptacle designed to meet the demand for a high-grade plug and receptacle at an attractive price. The internal construction prevents arcing across the contacts even on high voltage. The receptacle is interchangeable in that it provides for the use of either a surface plug or polarity plug. The receptacle, however, may be installed



Flush Receptable and Polarity Plug.

regardless of the character of the plug that may be used.

The plug is readily inserted and withdrawn from the receptacle. The polarity is for use with small motors, heating appliances, etc., and for laboratory and experimental work where the polarity must not be reversed.

The receptacle can be wired without removing the cap. Exceptionally large contact surface is provided. The plug is made of strong, durable composition, and is easy to wire.

The receptacle is one and three-sixteenth inches deep, allowing ample room for wiring in shallow wall box, or it will fit any standard switch box.

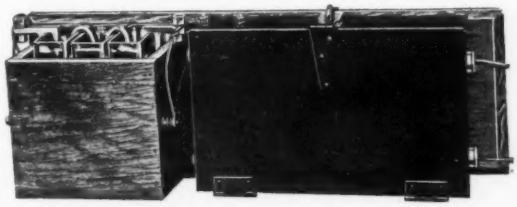
The receptacle is finished in brushed brass or old brass, where other finishes are not specified.

Beacon Direct-Current Bell-Ringing Outfit.

For several years the bell-ringing transformer has proven a very convenient and trouble-saving means for operating extensive systems of bells, buzzers, annunciators, door-openers, burglar and fire alarms, etc., from standard alternating-current lighting systems. An outfit providing the same service from direct-current lines has been placed on the market by the Electric Economy Company, 64 Warren Street, Roxbury, Mass.

This outfit, known as the Beacon direct-current bell-ringer, consists of three or more small storage cells connected in series with a pair of high-resistance coils and a cutout, the entire outfit put up in a compact form and connected to the direct-current lighting circuit. The series resistance is so proportioned as to allow a very small charging current to pass through the battery continuously, thus keeping it constantly in full reserve condition. The power consumed from the line is only two or three watts, so that the operating cost is only one-half cent or less per day. The cells are provided with glass covers so that there is but little evaporation of electrolyte; a few

times a year a little water is added to make up for this loss and this is the only attention that is required. The low-voltage circuits are connected directly across the battery. Three cells are ordinarily provided, since six-volt circuits are most common for this service. The continual charge causes a very slow disintegration of the active material of the positive plates but even the grids themselves have sufficient capacity for ordinary light service. Where the low-voltage service is severe, however, another set of positive plates can be installed at low cost. This is required once in about three to ten years, depending on the low-voltage load and the voltage-regulation of the lighting circuit. The cells when new have a reserve capacity of about six ampere-hours, or enough to ring a common bell continuously for 12 hours, if the charging current were cut off.



Beacon Direct-Current Bell-Ringing Outfit, Showing Storage Battery with Resistance and Cutout Cabinet.

The apparatus has been approved by inspectors wherever installed. It is of simple and rugged construction. It is particularly adapted for apartment houses, large residences, office buildings, hotels, factories, etc., where heavy service makes all forms of primary batteries troublesome or unreliable.

Synchronous-Motor-Driven Air Compressor.

The rapidly increasing use of synchronous motors, because of their inherent advantages for certain lines of industrial work, is particularly well exemplified in the installation in Central Park, New York City, in connection with the tunnel being driven under the city, which is a portion of the Catskill Aqueduct system. The water supply for New York City is being brought from a watershed in the Catskill Mountains, 150 miles away. This involves crossing under the Hudson River by means of a pressure tunnel, or inverted siphon, over 3,000 feet long and 1,100 feet deep.

An interesting point in this wonderful engineering work is that the water is brought all the way under the ground instead of, as is usually done, by means of viaducts when crossing the valleys or lower portions of the country.

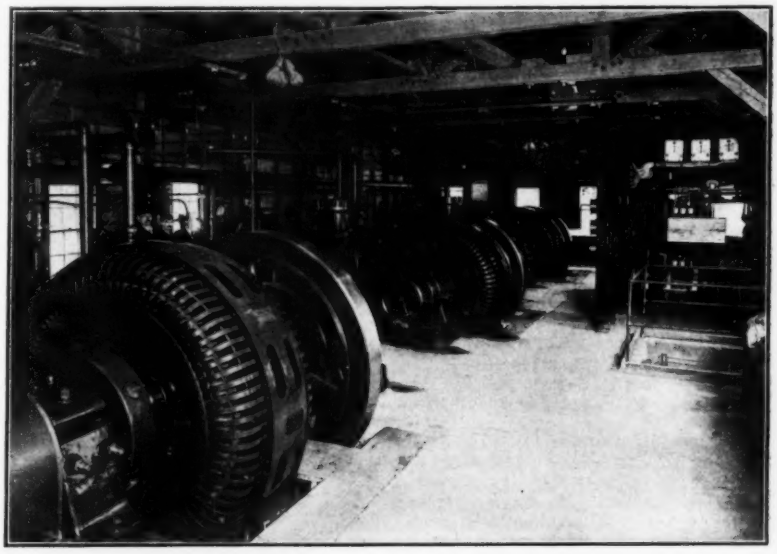
In the borough of Manhattan, the water is carried from Ninety-ninth Street to Fourteenth Street, a distance of 4.38 miles, in a tunnel cut through solid rock its entire length, about 225 feet below the level of the streets. It has a finished bore of 14 feet inside the concrete lining down to Forty-second Street, 13 feet to Twenty-third Street, and 12 feet from there to Fourteenth Street.

The six shafts sunk were located as follows: three in Central Park, at Ninety-third Street, Eighty-first Street, and Sixty-sixth Street; one at Fiftieth Street and Fifth Avenue; one at Forty-second street at Bryant Park; one at Twenty-fifth street and Broadway. Drilling is done by means of compressed air drills, motive power for which is supplied to the three Central Park shafts from a Compressor plant located in the park.

The plant consists of three Sullivan two-stage air compressors, each direct-connected to a 400-horsepower, 6,600-volt, three-phase, 25-cycle, Westinghouse type-E self-starting synchronous motor running at 187.5 revolutions per minute. The compressors are equipped with 15.5-inch high-pressure cylinders, 26-inch low-pressure cylinders, and have 18-inch strokes giving a piston displacement of 2,070 cubic feet of air per minute, at the rated speed of the motor. A vertical intercooler with copper water tubes, placed between the high and low-pressure air cylinders, provides 10.75 square feet of cooling area per 100 cubic feet of air.

The volume of air delivered is proportioned to the demand by means of a double-beat unloading valve on the air inlet of the intake cylinder. This valve is either fully open or tightly closed, so that there is no choking effect on the entering air. It is operated by a variation of five pounds in the receiver pressure. A 3.5-ton flywheel renders the operation of the outfit very smooth and eliminates any objectionable peaks in the power-consumption curve.

The motor, as above stated, is of the synchronous type and is especially adapted for compressor service. A particular advantage of this type is that, in addition to its use as a motor, it may be employed as a synchronous condenser to improve the power-factor of the circuit, this being accomplished by adjusting the field excitation. Direct current at 125 volts is furnished for the field excitation by an exciter mounted on the compressor frame and driven by a belt from the crankshaft. The revolving portion of the motor is provided with a combined starting and damper winding so proportioned that the necessary starting torque is developed by the minimum line current, consistent with the synchronous operation.



Synchronous Motors Driving Air Compressors.

This starting winding is similar in construction and operation to the well known squirrel-cage induction-motor-rotor winding.

The total weight of the outfit is 31 tons. Accurate tests made by competent engineers show an output of 345 cubic feet of air per kilowatt-hour.

Latest Approved Fittings

ATTACHMENT PLUG, FUSELESS.—Peru Electric Company, Peru, Ind.

"Peru," 6 amperes, 125 volts; 3 amperes, 250 volts. Separate cap, catalog No. 2286.

Approved November 5, 1912.

CABINETS.—Butte Engineering & Electric Company, 683 Howard Street, San Francisco, Cal.

Approved November 22, 1912.

FIXTURES.—W. H. Jenks, 617 East Main Street, Richmond, Va.

Approved November 11, 1912.

FIXTURES.—Wilmarth Show Case Company, Grand Rapids, Mich.

A line of fixtures for use in show cases. All wiring in steel tubing.

Approved November 26, 1912.

FUSES, Cartridge Inclosed.—Briner Electric Company, 811-813 North Second Street, St. Louis, Mo.

Fig. 1.—Low-Voltage Transformer.—Maloney Electric Company.

"St. Louis" cartridge inclosed fuses, 0-300 amperes, 250 volts; 0-200 amperes, 600 volts.

Approved November 8, 1912.

FUSES, PLUG.—Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill.

Edison plug fuses, 3 to 30 amperes, 125 volts.

Approved November 11, 1912.

FLEXIBLE TUBING CLAMPS.—T. W. Manufacturing Company, 713 Majestic Building, Milwaukee, Wis.

Pressed-metal clamps for supporting flexible tubing and holding the same at outlets.

Type A clamp, for use at combination gas and electric outlets.

Type B clamp, for use at straight electric outlets.

Approved November 4, 1912.

INSULATING MATERIALS.—Northern Industrial Chemical Company, 68 Northampton Street, Boston, Mass.

The electric fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

"Roxite" molded insulating material.

A molded insulating, non-combustible compound of good dielectric and mechanical strength, unaffected by oils or

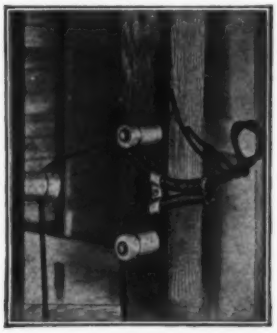


Fig. 2.—Flexible Tubing Clamp.—T. W. Manufacturing Company.

acids and very slightly absorptive of moisture.

Approved November 11, 1912.

LAMP ADJUSTER.—Chicago Fire Apparatus Company, 208 North Fifth Avenue, Chicago, Ill.

A lamp adjuster consisting of a

Fig. 3.—Another View of Flexible-Tubing Clamp.

spring-actuated drum over which is wound a supporting cord.

Approved December 14, 1912.

RECEPTACLES, For Attachment Plugs.—Conlan Electric Company, 43 Murray Street, New York, N. Y.

"Conlan Valve-Closed Watertight" receptacle and plug, 5 amperes, 250 volts.

A receptacle mounted inside a special conduit-box cover and provided with a spring-operated valve for watertight closure, together with a plug having a metal protecting skirt and water-tight terminal compartment.

Approved November 15, 1912.

RECEPTACLES, Standard.—Appleton Electric Company, 212-214 North Jefferson Street, Chicago, Ill.

Keyless receptacles for one-half, three-fourths and one-inch rectangular Unilets; 660 watts, 250 volts.

Fig. 4.—Pendent Snap Switch.—C. S. Knowles.

Without shadeholder groove, catalog Nos. 7650-7652 inclusive.

With shadeholder groove, catalog Nos. 7660-7662 inclusive.

Approved November 11, 1912.

SOCKETS, STANDARD.—C. S. Knowles, 7 Arch Street, Boston, Mass.

"Zee" sockets, 660 watts, 250 volts; catalog Nos. 600 (one-eighth-inch key), 700 (three-eighths-inch key).

Approved October 21, 1912.

SWITCHES, PUSH-BUTTON FLUSH.—Manhattan Electrical Supply Company, 17 Park Place, New York.

Approved November 1, 1912.

SWITCHES, Pendant Snap.—C. S. Knowles, 7 Arch Street, Boston, Mass.

Approved October 4, 1912.

TRANSFORMERS.—Moloney Electric Company, St. Louis, Mo.

Air-cooled transformers for indoor or outdoor use for 110 and 220-volt primary, giving 11 to 22-volt secondary.

Approved November 15, 1912.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

ARMSTRONG, IOWA.—The electric light franchise carried and a plant will be installed at once. C.

MT. PLEASANT, PA.—The Mountain Power Company has been granted a franchise to operate in this city.

SALINA, KAN.—F. D. Shellabarger expects to spend about $50,000 on a new power plant in this city.

YARDVILLE, N. J.—The Public Service Electric Corporation will install a distributing system at Yardville. A.

ATLANTA, GA.—Joel Hunt, president of the Atlanta Realty Corporation, has been granted a permit to erect a $150,000 power plant.

ALBION, O.—It is understood that options have been obtained on two different sites here for a municipal lighting plant.

GOSHEN, IND.—The City Council is preparing to install a new lighting system on Indiana Avenue, south of Lincoln Avenue.

LOS ANGELES, CAL. — The Southern California Edison Company is preparing to extend its lines from Pomona to Chino.

WINNEPEG, MAN.—This city is to build another transmission line, which, it is estimated, will cost in the neighborhood of $700,000.

STOCKTON, CAL. — The Oro Electric Corporation has been granted a 50-year electric light and power franchise in this city.

LOS ANGELES, CAL. — The City Council has advertised for bids for the maintenance of 3,702 old and 750 new electric arc lights for one year.

BREMOND, TEX.—The Bremond Electric Light Company is preparing to install an electric light plant here. The company will also install an ice factory. D.

GREAT FALLS, MONT. — The Great Falls Power Company will start work at once for the construction of a power dam at the Big Falls of the Missouri. C.

SAN SABA, TEX.—The San Saba Corporation Board has granted a charter to the San Saba Electric Light Company to keep electric lights on the streets for the next 50 years.

JAMESTOWN, CAL. — The Board of Supervisors will receive bids until January 7 for the installation of a lighting and power system in the Jamestown Lighting District.

EAST MOLINE, ILL.—The City Council of this city has decided to investigate the cost of maintenance of a municipal electric lighting plant. The citizens all seem to favor municipal lighting.

ELMA, WASH. — The Board of County Commissioners has granted a franchise to the Elma Light & Power Company to erect a transmission line along a portion of the county roads.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has appropriated $60,000 for the betterment of the light and power service in and about the town of Dixon, Cal.

HUMBOLDT, S. D.—Arrangements have been made for an electric light system to be furnished by an electric light company at Hartford, which will begin extension to Humboldt at once.

COLUMBIA, S. C.—The Manufacturers' Power Company, of Spartansburg, has been chartered here with a capital stock of $700,000 to develop a water-power plant in Spartansburg County.

VANCOUVER, B. C. — The Fort Fraser Industrial Corporation, Limited, has been organized here and will shortly be incorporated for the purpose of putting in a power plant at Fort Fraser.

ELSINORE, CAL. — The Elsinore Light & Power Company has been sold to the Southern Sierras Power Company of Los Angeles. A number of improvements in the Elsinore plant are planned.

CLEVELAND, O.—The Caxton Power Company has been given authority to issue additional stock in the amount of $1,000 for the purpose of improving the company's property in this city.

LOUISVILLE, KY. — The Kentucky Paint & Glass Company, 314 East Market Street, this city, will require motors for the operation of paint mills which it is to purchase in the near future. G.

BUCKLEY, WASH.—P. H. Hebb, of Tacoma, has been granted a 50-year franchise to furnish Buckley with power for lighting purposes. Mr. Hebb has franchise ordinances pending in both Seattle and Tacoma.

WINCHESTER, KY.—It is reported that the Kentucky Utilities Company, which is owned by the Insull interests, of Chicago, Ill., is to build a central power plant near this city for the service of its Kentucky properties. G.

BIRMINGHAM, ALA. — The Coosa River Power Company has been granted an extension of one year in which to begin work to furnish electric current and power to this city. The original franchise stated that work was to commence by December 31, 1912.

LONDON, KY. — James Williamr and E. A. Pollard, of this city, are to establish an electric light plant at Hazard, which has recently developed as a coal mining center. A steam laundry will be run in connection with the lighting proposition. G.

ROCKVILLE, MD.—The Potomac Power & Electric Company, of Washington, has been granted permission to extend its electric lighting lines from Rockville, along the Frederick Road, to Gaithersburg, and from there to Derwood and Washington Grove.

INDIANAPOLIS, IND. — The Evansville Public Service Company, which is a merger of the Evansville Gas & Electric Light Company and the Evansville Public Service Company, has filed articles of incorporation with a capital stock of $1,350,000.

NEW BRUNSWICK, N. J.—The Board of Public Utility Commissioners has approved of ordinances granting the Middlesex & Monmouth Electric Light, Heat & Power Company permission to operate in Marlboro, Holmdel and Matawan Townships.

NEW HAVEN, CONN.—The Shore Line Electric Railway Company, the Plant system, is desirous of extending its territory within which to sell electricity for lighting and power to several of the shore towns east of New Haven, through which its main line runs.

JEFFERSONVILLE, N. Y.—This village has a municipal electric light plant under consideration and proposes to secure the rights of the dam site of the tannery and install a plant having 100-horsepower generator, the construction of a 20-foot dam and the erection of two miles of poles and wires.

ST. LOUIS, MO.—Missouri Power & Service Company has been incorporated with a capital stock of $2,000. The incorporators are A. D. Cable, John F. Ryan and William E. Miner. The purpose of the company is to acquire, build and operate plants for the purpose of generating power, light, heat, etc.

LEXINGTON, KY.—The Kentucky Utilities Company has purchased a franchise from Woodford County, Ky., enabling it to build transmission lines over turnpikes in that county. The company is planning to furnish electric light service to a number of counties within a reasonable distance of Lexington. G.

ANOKA, MINN. — The Great Northern Improvement Company, which is understood to be allied with the General Electric Company, is starting preliminary work for the development of the water power at Coon Creek on the Mississippi River. It is thought that there will be a 30-foot head. C.

HARRISBURG, PA. — Articles of incorporation have been filed under the laws of Pennsylvania for the incorporation of a new concern which will be called the Tioga Electric Light, Heat & Power Company, to operate in and around Wilkesbarre, Pa., with a capital of $5,000; also for the Electric Light, Heat & Power Company, with a capital of $10,000, to operate in and around Scranton, Pa. N.

PINEVILLE, KY.—F. M. Wilkes, of Lexington, Ky., is representing interests which plan the construction of a water-power plant on Cumberland River near this city for the purpose of supplying service to Pineville and neighboring cities and coal mines. It is not known exactly who are behind the project. G.

CHESTER, PA.—Crosby M. Black, president of the Chester Development Company, has completed negotiations for the purchase of two acres of land from the Porter estate in Marcus Hook, Pa., for the Beacon Light Company of Chester, Pa., which company proposes to erect a modern substation on the site. N.

SAFFORD, ARIZ.—The Farmers' Association of Safford has taken preliminary steps towards installing a central electric-power station here and the construction of a system of transmission lines to irrigation pumping plants that are to be installed upon a large irrigation district that is to be formed near Safford. D.

CHICAGO, ILL.—The Union Central Electric Company, an announcement of the incorporation of which with a capital stock of $5,000 was made some time ago, has been sold to the Central Illinois Utilities Company, operating in about 100 towns in Lane, Livingston and Franklin counties. L. E. Myers, Chicago, Ill., is the leading spirit in the organization.

OKLAHOMA CITY, OKLA.—An Oklahoma charter has been issued to the Broken Bow Light & Power Company with a capital of $5,000. The incorporators are H. M. Kirkpatrick, C. E. Baxter, and A. E. Hart, of Idabel; F. H. Dierks, H. L. Dierks, Herman Dierks, Hans Dierks, Kansas City, Mo. It is backed by the Dierks Lumber Company, which has a big mill at Broken Bow and practically owns the town. P.

SANTA ROSALIA, CHIHUAHUA, MEX.—The Mexican Northern Power Company is constructing an electric power transmission line from the hydroelectric plant it is installing on the Conchos River, about 18 miles from Santa Rosalia, to Parral. It will also construct lines of this character to Chihuahua, Jiminez, Santa Barbara, Santa Eulalia and a number of other cities and mining districts of the state. The hydroelectric plant will have a capacity, it is stated, of more than 100,000 horsepower. This company is composed of Canadian people and it has its principal office in Montreal. William B. Fuller is chief engineer. The contractors are S. Pearson and Son, of London, England, and the City of Mexico. P. L. Bloston is general superintendent. D.

SCRANTON, PA.—The incorporators of the Scranton Electric Light, Heat & Power Company are Frank J. Mulholland, Joseph M. Walsh, William J. Prior, John Gill and Fred Linn. The company will not enter the competitive market for the sale of light, heat and power but is supposed to be a subsidiary of the Scranton Railway Company, and with the completion of the plant it will furnish power to the Scranton Railway Company, and if the Electric Light & Power Company does not build another plant near one of the culm banks and deliver the power by cable it will surely take over the plants of the Scranton Railway Company and relieve that company of the expense of power supply and at the same time be financially in a position to supply all necessary power. N.

TROY, N. Y.—According to a report received by Mayor Burns from the Conservation Commission, a state conservation hydroelectro power dam is in contemplation. This dam would furnish power for Troy, Albany, Schenectady, Cohoes, Watervliet, Rensselaer and other contiguous places. The report states that the state will be enabled to develop and generate from its own dams on the barge canal in the Mohawk River some 35,000 horsepower, which, being in the center of the capital district, would be of incalculable benefit to these cities. When the barge canal is completed there will be two dams on the Mohawk River, one at Crescent and one at Vischers Ferry. It is claimed that the installation of such a plant would cost about $1,600,000.

HARTFORD, CONN.—The field of the Northern Connecticut Power Company is to be directly invaded by the Farmington River Power Company, which now supplies electrical power from its plant on the Farmington River at Tariffville in the towns of Hartford, Windsor, Windsor Locks, West Hartford and Bloomfield. It also proposes to lock horns with the Hartford Electric Light Company within the city of Hartford. In the Farmington Company's charter there is a provision that it may enter Hartford with wires or conduits only for the purpose of conducting power to central stations and it will ask to have this restriction removed. It already has the right to go into Windsor and Windsor Locks, where the new dam is to be located, but it now seeks the right to go into the towns of Suffield and Enfield, which are the heart of the territory of the Northern Connecticut Company and in the latter of which the steam plant, which it is already operating, is located. The Farmington company will also seek the right to increase its capital from $250,000 to $500,000 and to issue $150,000 in bonds, making a total of $650,000.

HARTFORD, CONN.—The Housatonic Power Company, which is owned by the New Haven Road, intends to petition for the right to build a series of additional dams on the Housatonic River. Its plans call for a new dam in the town of Bridgewater, between the point where the Pootatuck River flows into the Housatonic and Southville, to have a height of 35 feet above the present level of the river; another to be located below the present dam at Bull's Bridge, north of New Milford between the pool of the lower dam and Lover's Leap, the dam to be five feet high; and for a third new dam on the Shepaug River at Roxbury Falls, some six miles north of where this branch, which comes from Bantam Lake, flows into the main river at Southbury. This latter dam taps a stream with a powerful flow of water which the Housatonic Company has had rights on that have never been used. The dam here is to be 25 feet in height and back of it will be stored a great amount of water. These dams are not to be built for the mere impounding of water, however, but to develop to much nearer its capabilities a water power of great value, which is being but little used. One of the principal features of the scheme is still another dam across the Housatonic just below the mouth at the Shepaug River, a huge and high affair, which will provide a very large amount of power.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

RYEGATE, MONT.—J. E. Rounds is working to secure the establishment of a telephone exchange. C.

NAPA, CAL.—D. C. Priest has been granted a telephone franchise over certain streets in this county.

TITONKA, IOWA.—Business men talk of forming a local company to engage in the telephone business.

BAKER, *via* BRINSMADE, N. D.—The Commercial club is working to secure a local telephone exchange

RIALTO, CAL.—The Pacific Telephone & Telegraph Company has been granted a telephone franchise in this city.

LOS ANGELES, CAL.—The American District Telegraph Company has been granted a franchise in this city.

COIN, IOWA.—The Coin & College Springs Star Line Mutual Telephone Company has filed articles of incorporation. C.

ELKO, NEV.—The Bell Telephone Company is extending its lines across the state of Nevada and is expected to install a system in Elko.

HAGERSTOWN, MD.—The Chesapeake & Potomac Telephone Company has obtained a 40-year franchise from the City Council. K.

COLFAX, WASH.—Moys Telephone Company has been incorporated with a capital stock of $2,700 by John Bloom, F. P. Coply and others.

RIO GRANDE CITY, TEX.—James Beasley and associates are preparing to install a telephone system in this city and extensions to other towns throughout the county.

ABERDEEN WASH.—J. A. Chambers has taken a contract to build a rural telephone line through the North River country. It will be about 20 miles long. C.

LEWISBURG, TENN.—The Cumberland Telephone & Telegraph Company will, it is announced, install a flash-light system in this city, which will necessitate an expenditure of about $35,000.

EL RENO, OKLA.—The Oak Valley Telephone Company has been incorporated with a capital stock of $800 by T. E. Morris and F. S. Ball, of El Reno; and G. H. Locke, of Calvert.

SAUGUS, MASS.—The New England Telephone & Telegraph Company is preparing to install a telephone exchange with a modern system in Saugus. The new work is estimated to cost about $22,000.

WARSAW, N. Y.—Warsaw Rural Telephone Company, Incorporated, has been granted articles of incorporation with a capital stock of $3,000 by Floyd B. Stearns, William E. Herman, A. W. Morgan and H. A. Flint, all of Warsaw.

EUREKA, CAL.—Eureka Telephone Company has been incorporated with a capital stock of $2,000 to enter the general telephone and electric business. M. F. Melick, Clinton F. Melick and Carrie M. Melick are the incorporators.

JAMESTOWN, N. D.—Under a decree of the United States court the properties of the Mutual Electrical Construction Company and the Kellogg Switch Board & Supply Company will be sold at auction January 22 at the courthouse. C.

WESTERNVILLE, N. Y.—Westernville Rural Telephone Company, Incorporated, has been granted articles of incorporation with a capital stock of $10,000. The incorporators are D. E. Dillenbeck, Sarah Dillenbeck and Alice E. Dillenbeck, all of North Western, N. Y.

PITTSBURGH, PA.—Superintendent of Public Buildings C. L. Woolridge, has asked Council to act on his request that fire alarm boxes be placed in all of the 126 public school buildings. Mr. Woolridge states that he fears a disaster some day, as some of the school buildings are some distance from alarm boxes.

PHILADELPHIA, PA. — It was learned from L. H. Kinnard, second vice-president and general manager of the Bell Telephone Company, that $59,700 has been appropriated for extensive additions and improvements to the system in Philadelphia and vicinity. The work covered by this appropriation includes a two-position switchboard for the Ritz-Carlton Hotel, underground conduit on North Seventeenth Street, from Vine to North Streets, and 31,000 duct feet of underground conduit to be used in various sections of this city. Underground conduit for the new Logan Central Office, which has been under course of construction for some time, is also included and $20,900 for new trunks between the Spruce and Tioga Central Offices as well as $11,000 for the improvement in the Philadelphia toll central office. Mr. Kinnard said that the present calling rate a day was about 500,000 in Philadelphia and about 25,000,000 throughout the Bell System. N.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CLINTON, IOWA.—The Clinton Street Railway Company has been petitioned to extend its line to the Hill district in Southwestern Clinton. C.

PROVO, UTAH.—A franchise has been granted to John MacGinnis, Thaddeus S. Lane and others for an interurban railroad through this city.

HOUSTON, TEX.—The Anderson-Stille-Force Company has announced that construction work will soon start on the new car line to the Houston Harbor.

ORANGE, CAL.—The Board of Supervisors is advertising for bids for a single or double track electric railway along certain public highways of Orange County.

NEW BRITAIN, CONN.—Manager F. L. Beardsley of the Connecticut Company has recommended to his company the building of a street-car system in the Fifth Ward.

RICHMOND, CAL.—The Southern Pacific Company has applied for a 50-year electric-railway franchise in this city. The franchise has been advertised for sale on January 20.

FORT WORTH, TEX.—The Texas Traction Company announces that it will extend its Sherman Electric Railway system from Lamar Street, in that city, to the St. Vincent's sanitarium. D.

CLEBURNE, TEX.—Daniel Hewett has acquired a controlling interest in the street railway system of Cleburne and will extend the lines and make other improvements.

DEVILS LAKE, N. D.—The Brazil, Devils Lake & Minneapolis Electric Railway Company has been incorporated to build a railway line east and west from this city, operating with gasoline-electric motors. C.

EAU CLAIRE, WIS.—The Chippewa Valley Railway, Light & Power Company proposes to erect a six-story building. An interurban line to Altoona is also to be constructed, and possibly one to Menomonie. C.

STOCKTON, CAL.—Charles M. Hayden, president of the Calaveras Copper Company, announces that his company is preparing to build a 16-mile electric railway connecting its mining property with Stockton.

RIDGEFIELD PARK, N. J.—The Public Service Corporation will extend its electric railway system to connect with the Hudson River Traction system at the junction of Bogota and Teaneck, by way of Ridgefield Park.

MADISON, WIS.—The Central Wisconsin Construction Company has been incorporated with a capital stock of $25,000 to continue the building of the Chicago & Western Valley Company's interurban line between here and Portage. J. E. Jones, Portage, is president.

RIVERSIDE, CAL.—The Board of Supervisors of Riverside County has granted permission to the Pacific Electric Railway Company to extend its Riverside-Magnolia Avenue line as far as Corona on the way to LaHabra, a distance of seven miles.

IDAHO FALLS, IDAHO.—It is said that it is the intention of the Idaho Power & Transmission Company to increase its plant to supply a large amount of electric power and begin the construction of the proposed interurban railroad.

SARNIA, ONT.—The Lake Huron Shore Railway, which it is proposed to build from Sarnia to Meaford, on Georgian Bay, is meeting with considerable favorable comment. The line would pass through a rich fruit belt and no doubt be a big boon to the summer-resort business on the lake shore.

MOBERLY, MO.—The citizens of this place have subscribed more than $7,500 toward securing the right of way of a standard electric railway from Randolph Springs to the Wabash station. Charles H. Dameron, owner of the above resort, is promoting the enterprise. The distance is eight miles.

AUSTIN, TEX.—T. K. Smith, of Indianapolis, and associates are promoting the construction of an interurban electric railway between Austin and Fredericksburg, about 75 miles. The route of the proposed road is *via* Johnson City and is in a territory that is now without railroad transportation facilities. D.

FERGUS FALLS, MINN.—It is understood here that the street railway, for which a franchise was obtained last year, will now be built. The power company announces that it will establish a 70-foot fall just above the city and the railway men are planning to lose no time in putting in the railway.

JACKSONVILLE, FLA.—March is the time set for the beginning of the construction of the interurban line to run between this city and St. Augustine. The company which is to build the road, the Jacksonville & St. Augustine Public Service Corporation, has been capitalized at $2,000,000 and the stock is held by the leading financiers of these two cities.

TAYLORSVILLE, KY.—The Taylorsville, Louisville & Jeffersontown Trolley Company has been organized for the purpose of building a traction line from Taylorsville to Jeffersontown. Surveys have been completed. The Louisville Railway Company will be asked to undertake construction of the line. I. F. Jewell, Rowland Cox and others are interested. G.

ATLANTA, GA.— The Georgia Railroad & Power Company is planning to spend $1,250,000 for the improvement of its trolley system in this city during the coming year. This appropriation does not include new lines which the company intends to build. It is understood that an extension of the old Decatur line will be built to Stone Mountain, a distance of 16 miles.

STANDARDSVILLE, VA.—John S. Chapman, B. I. Bickers, H. C. Jarrell, E. M. Averill, E. D. Durrette and others, it is understood, have subscribed for the construction of an electric railway from Madison Courthouse south to Liberty Mills, with a line between the latter place and Standardsville. It is understood that an extension will also be built to Orange or Gordonsville. The line would be about 35 miles in length, all told, and the cost is estimated at $500,000.

NEW HAVEN, CONN.—The Connecticut Company, the New Haven's trolley corporation, is to ask for extensions of its charter rights to build where it now has no lines, and in some cases the extensions asked for are entirely new, as in Norwalk, South Norwalk, Fairfield, Bridgeport, Stratford, Milford, New Britain, Ansonia, Berlin, Waterbury, Hartford and New Haven, besides the new line to connect the Waterbury-New Haven and Bridgeport-New Haven interurban lines in the towns of Milford and Orange, to afford direct trolley connection with the Sound shore resorts for Western Connecticut inland places.

JENNINGS, LA.—The reported plans of capitalists to build an electric railway from this city to Houston, Tex., has aroused much interest in this section of the state. Its significance is increased, coming as it does so closely upon the organization of the Louisiana Traction & Power Company, which will construct lines from Lake Charles to Jennings, Lafayette, New Iberia, Abbeville and other Louisiana points, and the further activity of the Southwestern Traction Company in building out of New Iberia westward to some point in this section of the state. Backing this up is a further report that the K. C. S. will extend its lines from Lake Charles into New Orleans during 1913-14. It is not known here just what will be the outcome of the latest move to build from New Orleans to Houston, but it seems an absolute certainty that the Louisiana Traction Company will soon start building out of Lake Charles and Lafayette into Jennings, Welsh, Lake Arthur, New Iberia, Broussard, Abbeville and other points. It seems equally certain that the Southwestern company, in which New Orleans capital is interested, will head this way from its present terminus in New Iberia, and perhaps also extend its lines into Morgan City and, eventually into New Orleans. Should all the projects be consummated Southwest Louisiana will be a veritable network of electric railways in the next two or three years.

NEW INCORPORATIONS.

FLINT, MICH.—Reliable Trolley Retriever Company has been incorporated with a capital stock of $10,000 for the purpose of manufacturing electrical appliances.

AUGUSTA, ME.—W. C. Laughlin Company has been organized for the purpose of owning and operating railroads, telegraph or telephone, gas or electrical companies, with a capital stock of $500,000. The president and treasurer of the company is E. M. Leavitt, of this city.

CHICAGO, ILL.—The Electric Generator & Accumulator Company has been incorporated with a capital stock of $15,000 for the purpose of manufacturing and dealing in electrical apparatus. Philip L. Knoedler, Frederick W. McKenna, Charles B. Askow, Monroe Mitchell and James M. Snitzler are the incorporators.

MARION, IND.—The Railway Safety Device Company has filed articles of incorporation with a capital stock of $25,000. The company proposes to manufacture and sell derailer automatic switchlocks and other safety devices for use by electric and steam railroads. B. B. Shively, M. C. Shroderbeck, M. L. Leapy and William Carroll are directors. S.

HARRISBURG, PA.—Papers have been filed for the incorporation of 13 electric companies of Lancaster County into the Edison Electric Company, of which W. W. Griest is president. The incorporated companies are the Elizabethtown, Marietta, Martic, Coney, Eden, Conestoga, West Earl, Upper Leacock, Strauburg and Pequa, and they are all chartered for the counties from which they take their names.

FINANCIAL NOTES.

The impending settlements and disbursements have resulted in a slowing up of activities in speculative centers. Industrial securities having a sound financial basis have not been greatly depressed, nor is the business of the companies represented by these securities in a bad way. The industrial companies in the year just ended have passed through and are still in a most profitable period.

The stockholders of the Electrical Securities Corporation have authorized the increase of $500,000 in the common stock, making the total authorized $2,500,000.

Advices from Ottawa state that Parliament has been asked to authorize an increase in the capital stock of the Ottawa Electric Company from $1,500,000 to $3,000,000.

The directors of the Hartford Electric Light Company have voted to recommend to the stockholders an increase in the outstanding stock to $3,600,000 from $3,000,000. The authorized issue is $5,000,000. The stockholders will meet on January 8 to vote on the proposition. If it is approved stockholders will be given the right to subscribe to one share of new stock for every five shares of old, payable in two installments, one on February 4 and the other on August 5.

Net earnings of the National Carbon Company for its fiscal year ended December 31, will probably equal the record results obtained in 1910 when a balance of $1,303,000 was shown for the stock. For the first ten months of this year net profits have been 40 per cent ahead of the same months last year. The gain in gross has been about 12 per cent, so that, proportionally speaking, the advance in net has been much more marked and decisive than the expansion of sales. Gross sales for the year are likely to show an increase of about $400,000, practically all of which has been saved for net. Net profits of $1,300,000 would mean a balance of 15 per cent for the $5,500,000 common, after taking out the preferred dividend.

Dividends.

Birmingham Railway, Light & Power Company; a common dividend of 4 per cent, and a preferred dividend of 3 per cent, both payable December 30 to stock of record December 22.

Bell Telephone Company of Pennsylvania; a quarterly dividend of 1.5 per cent, payable January 15 to stock of record January 3.

Butte Electric & Power Company; a quarterly common dividend of 1.75 per cent, payable January 2 to stock of record November 30.

Chippewa Valley Railway, Light & Power Company; a quarterly common dividend of 2 per cent, payable January 15 to stock of record December 30.

Cincinnati & Hamilton Traction Company; a quarterly common dividend of one per cent, and a preferred dividend of 1.25 per cent, both payable January 2 to stock of record December 21.

Cincinnati, Newport & Covington Traction & Light Company; a quarterly common dividend of 1.375 per cent, and a quarterly preferred dividend of 1.125 per cent, payable January 15.

Columbus, Newark & Zanesville Railway Company; a quarterly preferred dividend of 1.5 per cent, payable January 1 to stock of record December 24.

Columbus Railway, Gas & Electric Company; a quarterly preferred dividend of 1.5 per cent payable January 1.

Dayton Power & Light Company; a quarterly dividend of 1.5 per cent, payable January 15 to stock of record December 31.

Little Rock Railway & Electric Company; a common dividend of 5 per cent, and a preferred dividend of 3 per cent, payable January 1, to stock of record December 22.

Northern Ohio Traction & Light Company; a quarterly preferred dividend of 1.5 per cent, payable January 1 to stock of record December 15.

Ohio Traction Company; a common dividend of one per cent, payable December 31, to stock of record December 26.

Ottawa Electric Railway Company; a dividend of 3 per cent and an extra dividend of 4 per cent, payable January 1 to stock of record December 31.

United Railway, Gas & Electric Company; a preferred dividend of 1.5 per cent, payable January 2 to stock of record December 20.

U. S. Light & Heating Company; the regular semi-annual dividend of 3.5 per cent on the preferred stock, payable January 31 to stock of record January 11.

Reports of Earnings.

KINGS COUNTY ELECTRIC.

The Kings County Electric Light & Power Company reports as follows for November and eleven months ending November 30:

	1912	1911
November gross	$ 470,452	$ 449,580
Net after taxes	161,728	187,988
Other income debentures	2,328	5,038
Total income	159,400	193,027
Surplus after charges	87,165	120,791
11 months' gross	4,664,983	4,252,818
Net after taxes	1,602,654	1,579,649
Other income	28,155	61,386
Total income	1,630,809	1,641,035
Surplus after charges	836,817	880,232

NEW YORK RAILWAYS.

The New York Railways Company reports for October and four months as follows:

	Oct., 1912	July 1-Oct. 31
Gross	$1,255,203	$4,740,667
Net after taxes	466,415	1,717,810
Other income	37,976	138,286
Total income	504,391	1,856,097
Interest on underlying bonds	224,788	899,014
Interest on refunding 4s	54,331	217,322
Total interest	279,119	1,116,336
Balance	225,273	739,761
Passengers carried	24,227,585	91,475,490

UNION RAILWAY GAS & ELECTRIC.

	1912	1911
November gross	$ 386,771	$ 290,237
Surplus after charges	73,931	51,700
Twelve months gross	3,879,260	3,179,721
Surplus after charges	676,226	609,212

AURORA, ELGIN & CHICAGO.

	1912	1911
November gross	$155,213	$140,050
Net after taxes	53,853	53,247
Surplus after charges	26,803	21,519
Five months gross	895,032	83,767
Net after taxes	397,734	382,976
Surplus after charges	237,339	225,760

AMERICAN TRACTION.

The report of the American Light & Traction Company for November, 1912, the eleven months ended November 30, 1912, and the twelve months ended November 30, 1912, compares as follows:

	1912.	Increase
November gross	$ 404,581	$ 3,481
November net	395,143	3,584
Eleven months' gross	3,775,339	80,885
Eleven months' net	3,667,722	77,445
Twelve months' gross	4,224,939	103,406
Twelve months' net	4,107,688	100,280

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 28.	Dec. 21.
American Tel. & Tel. (New York)	140¾	140½
Commonwealth Edison (Chicago)	142½	142½
Edison Electric Illuminating (Boston)	280	280
Electric Company of America (Philadelphia)	12	*12¼
Electric Storage Battery common (Philadelphia)	53	52¼
Electric Storage Battery preferred (Philadelphia)	53	52¼
General Electric (New York)	184¾	184½
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1¼	1⅝
Massachusetts Electric common (Boston)	17½	17
Massachusetts Electric preferred (Boston)	75½	75
National Carbon common (Chicago)	120	120
National Carbon preferred (Chicago)	117½	117½
New England Telephone (Boston)	153¾	153
Philadelphia Electric (Philadelphia)	23⅝	24
Postal Telegraph and Cables common (New York)	80	82
Postal Telegraph and Cables preferred (New York)	65½	65½
Western Union (New York)	74¼	73¾
Westinghouse common (New York)	78½	80¼
Westinghouse preferred (New York)	119½	117½

*Last price quoted.

PERSONAL MENTION.

J. P. EDWARDS, for the past year special agent of the Western Union Telegraph Company, has been appointed division traffic superintendent, with headquarters at Atlanta, Ga.

M. L. HIBBARD, of the Union Light, Heat & Power Company, Fargo, N. D., has been appointed chairman of the Advertising Committee of the Fargo Home Products' Exhibition.

H. L. JACKMAN, of the Western States Gas & Electric Company, was elected vice-chairman of the Humboldt Promotion and Development Committee of the Chamber of Commerce of Eureka, Cal.

W. P. NASER, for the last four years connected with the New Orleans and Texas branches of the H. W. Johns-Manville Company, has been appointed sales manager of the Cravens Electric Company, Chicago, Ill.

WALTER CLARK, electrical engineer of the Victoria Falls & Transvaal Power Company of South Africa, which furnishes power for extensive mining properties on the Rand, has been on a visit to San Francisco and Alaska.

GEORGE R. DIVON, who has been connected with the Bell Telephone Company in Pittston and vicinity for several years, has been appointed local manager of the Williamsport (Pa.) branch. Mr. Divon and his family will make their future home in Williamsport.

W. R. THOMPSON, formerly assistant chief engineer of H. M. Byllesby & Company, has been appointed manager of engineering and construction. The duties devolving upon this position will include those formerly performed by Mr. Thompson.

H. M. BYLLESBY made an address at a meeting of the Bond Men's Club in Chicago, Ill., on December 19. His talk dealt with legislative action affecting public-utility corporations and the necessity for concerted effort in securing fair and reasonable laws in this domain.

L. E. ROBERTSON, formerly of the Suburban & Eastern Electric Railroad Company, will succeed H. A. Mitchell as general manager of the Central California Traction Company, with headquarters at Sacramento. Mr. Mitchell will become manager of the Oakland, Antioch & Eastern Electric Railway Company, with headquarters at Stockton, Cal.

WALTER D'ARCY RYAN, director of the Illuminating Laboratory of the General Electric Company, Schenectady, N. Y., who is engaged in perfecting the plans for the proposed illumination of the exposition at San Francisco, has devised a scheme of lighting that will utilize the celebrated "Frisco" fogs in diffusing beautiful color effects, with the aid of powerful reflectors of a type of his own invention.

J. C. FRANCIS HARDING, professor in the School of Electrical Engineering, Purdue University, Lafayette, Ind., has just returned from a trip to Madison, Wis., where he was called for a conference with the engineering department of the Wisconsin Railroad Commission in connection with the Milwaukee street-lighting investigation upon which he was engaged during the past summer.

PETER WEBER, general superintendent of the Edison factories at West Orange, N. J., for 15 years, and for 28 years altogether connected with the Edison interests, has resigned. It is understood that Mr. Weber has purchased a controlling interest in the business of Sloane & Chase Manufacturing Company, Newark, N. J., maker of machine tools, and will devote his time to the enterprise.

MASON B. STARRING has been elected president of the California Railway & Power Company, which was recently incorporated under the laws of Delaware with a capitalization of $60,000,000. It is said that this company will take over all the outstanding capital stocks of the United Railroads of San Francisco, San Francisco Electric Railway Company, Sierra & San Francisco Power Company and the Coast Valley Gas & Electric Company.

GEORGE H. HARRIES, ELMER DOVER and W. P JOHNSON have been elected vice-presidents of H. M. Byllesby & Company. General Harries has been in charge of the Louisville lighting companies and the Consumers Power Company of Minneapolis. Mr. Dover is in general charge of the Pacific Coast properties of the firm, and Mr. Johnson, formerly European representative of the International Harvester Company, is now in charge of the New York office.

OBITUARY.

LOUIS W. DUVALL, late secretary of the Public Service Commission of Maryland, was buried from his home in Baltimore, Md., on December 27, 1912. Members of the Public Service Commission, many prominent state officials and leading business men in all walks of life attended the obsequies.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.)

NO. 10,113. TELEPHONE EXCHANGE AND EQUIPMENT.—Supplementing a previous report, an American consul has transmitted specifications, with invitation for bids, for the installation of a new telephone exchange in his district. Copy of the complete report can be obtained from the Bureau.

NO. 10,127 BIMETALLIC WIRE—The American chargé de'affairs, Tangier, Morocco, has forwarded copies of the specifications and blank forms of proposals issued by the General Commission of Adjudications and Contracts for the Shereefian Government of Morocco for the supply of bimetallic wire for the use of the administration.

NO. 10,124. ELECTRIC METERS.—A report from an American consul in a Latin-American country states that an electric light company in his district will, during 1913, supply its customers with electric meters. This company is in immediate need of 300 meters, of 2 to 15 amperes, single phase, 125 volts, 60 cycles. Correspondence, in English or Spanish, should be addressed to the manager of the company.

NO. 10,131. PUMPING PLANT.—Tenders are invited by the Wellington City Corporation for the supply and delivery of a Weir feed pump, wrought-steel piping, cast-iron fittings, etc., for the electric tramways department. Tenders, made out on the proper form, will be received by the Town Clerk, Wellington, New Zealand, until February 6. Copies of the specification and form may be obtained from the office of the Tramways and Electrical Engineer, Harris Street, Wellington, on payment of $5.11, which will be refunded on receipt of a bona fide tender. Local representation is necessary.

NO. 10,126. ELECTRIC ELEVATORS.—An American consul reports that on account of the steadily growing population of his district, building operations have been greatly stimulated. With a tendency to higher buildings for residences, offices, and business purposes, there is a growing demand for the installation of electric elevators both for passenger and freight, and conditions are favorable for American manufacturers to compete for some of the new business offered. British firms, through long-established connections, practically control the business at present, but there seems to be a fair opportunity for an active agent to secure contracts for the American type of lifts. An effort should be made to introduce elevators with automatic gates.

PROPOSALS.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 24 for an electric passenger elevator in the courthouse at Texarkana, Tex. Copies of drawings and specifications may be obtained from the Supervising Architect.

ELECTRIC PASSENGER ELEVATORS.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 25 for three electric passenger elevators in connection with the reconstruction of the United States Barge Office, New York, N. Y., in accordance with drawings and specifications, copies of which may be obtained from the office of the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 13 for the electric conduit and wiring and interior lighting fixtures for the post office at Covington, Ky.; until January 30 of a one-story building for the post office at Biddeford, Me.; and until January 31 of a one-story building for the post office at Cedartown, Ga. Copies of drawings and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

DATES AHEAD.

Northwestern Cedarmen's Association. Annual meeting, Duluth, Minn., January 7-8, 1913.

South Dakota Independent Telephone Association. Sioux City, S. D., January 8-9, 1913.

American Institute of Consulting Engineers, Annual meeting, Engineer's Club, New York, N. Y., January 14, 1913.

Illinois Electrical Contractors' Association. Annual meeting, Peoria, Ill., January 17-18, 1913.

Peoria Electrical Show. Peoria, Ill., January 18-25, 1913.

Ohio Engineers' Society. Columbus, O., January 21, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association, Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

NEW PUBLICATIONS.

ELECTRICITY IN INDIA.—A history of the Tata hydroelectric project, serving the city of Bombay, India, has been published by the *Indian Textile Journal* of that city. The pamphlet includes also a description of the inaugural ceremonies and much matter relating to electric drive in textile mills.

IGNITION OF GAS BY INCANDESCENT LAMPS.—The Bureau of Mines has issued technical paper No. 28 by H. H. Clark entitled, "Ignition of Gas by Standard Incandescent Lamps." This describes a study of the behavior of these lamps when the bulbs are broken in gaseous atmospheres. The pamphlet, which comprises only three pages, gives the results of the tests which have been made.

WALLINGFORD ELECTRIC WORKS.—The report of the Board of Electrical Commissioners of the electric works of the Borough of Wallingford, Conn., for the year ending July 31, 1912, has been issued. A. L. Pierce is superintendent and electrical engineer. The report shows a gross income for the year of $41,846 and operating expenses of $22,727. After allowing for fixed charges and depreciation there is a net balance of over $3,000.

MINERAL PRODUCTION OF CANADA.—The Canadian Department of Mines has issued a general summary of the mineral production of Canada for 1911, by John McLeish. The production of 1911 is compared with 1910 and tables given for exports and imports. A discussion of the individual metallic ores is followed by similar treatment of non-metallic products, including coal, various minerals, cement and clay products. Statistics for smelter and refinery production are added.

With the Electrical Manufacturers

The Ohio Sterling Company, Dayton, O., has been placed in the hands of a receiver with the appointment of W. L. Caten on December 24.

The Bridgeport Brass Company, Bridgeport, Conn., has published a very interesting folder describing the electrical and mechanical characteristics and giving a number of illustrations of Phono-Electric wire.

The Emerson Electric Manufacturing Company, St. Louis, Mo., has ready for distribution its 1913 fan motor catalog. This catalog is complete in every detail, and should be in the hands of everyone interested in the matter of electric fans.

Hornberger Transformer Company, Lafayette, Ind., has moved its factory to larger quarters in the Oakland Hill district in order to accommodate increased business. The company has supplied many orders for high-tension transformers in Illinois and Indiana towns.

Edison Storage Battery Company, Orange, N. J., has begun work on the erection of two new large concrete buildings for increasing its manufacturing plant to meet the extraordinary demand for the Edison storage battery. These buildings will be of reinforced concrete construction.

The Calculagraph Company, 9-13 Maiden Lane, New York City, is distributing a handsomely printed catalog describing the calculagraph in business. The calculagraph is an accurate and scientific measure of elapsed time mechanically recorded, and produces accurate cost records in manufacturing industries. It is particularly applicable in the telephone and telegraph industry, and has also wide use among central stations.

The Federal Sign System (Electric), Chicago, Ill., has moved its general offices and sales offices from the Home Insurance Building to its new factory building at Lake and Desplaines Streets, as the recently completed addition to the Federal plant, made necessary by the steady growth of the company's business, doubles the space occupied by the company. Consolidation of the general offices and the manufacturing departments will result in increased efficiency in manufacture and prompt service for Federal patrons.

The Babcock & Wilcox Company, New York, N. Y., has issued a new 64-page book devoted to Stirling watertube boilers. The book is well bound in blue cloth and is copiously illustrated with many views of the boilers, sections, drums and other parts, as well as numerous installations in which Stirling boilers are exclusively used. The descriptive matter includes an account of the development of the boiler, a general description of its construction, a discussion of its operation, management and care, and a summary of several tests with various speeds.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., announces that its Kansas City sales office will be transferred to its Chicago branch at 708-710 West Jackson Boulevard. The traveling representatives in the Kansas City territory will call on the trade as regularly as before and offer every assistance in the way of service. It is announced that this change will enable the company to give its Southwestern customers better service than was furnished through the Kansas City branch. The company will continue to carry at Kansas City a selected stock of standard telephones boxed and ready for shipment to its customers in the Kansas City territory.

The Detroit Insulated Wire Company, Detroit, Mich., following its usual custom, has made a distribution of a goodly share of its profits among its employees. This distribution is based on the length, continuity and value of service. Hourly-rate employees having been with the company for one year or more will, as formerly, receive two per cent of his or her total wages since entering the continuous employ of the company. For instance, five years' steady employment entitles the employee to five times two per cent, or ten per cent of the average yearly wage. This will show the employees the value of sticking to their position without interruption. All monthly-rate employees having been with the company for one year or more will receive one per cent on all salaries earned since entering continuous employment.

Mesta Machine Company, West Homestead, Pa., made a special demonstration of two unique steam engines in the erecting shop of its works on December 28. A special train brought a large number of engineers and plant managers from Pittsburgh. One of these engines, a twin tandem-compound reversing engine with two 46 by 60-inch high-pressure cylinders and two 76 by 60 low-pressure cylinders, is the most powerful rolling-mill engine ever built. The other machine is a direct-flow steam engine with a single cylinder 28 by 42 inches, built for the power plant of Carnegie Institute of Technology; it is of very simple construction and yet has an economy comparable to that of compound engines and steam turbines.

Engineering Department of the National Electric Lamp Association, Cleveland, O., has issued two new bulletins devoted to Mazda lamps. Bulletin 10C is devoted to Mazda train-lighting lamps. It discusses the characteristics of these lamps, shows operating curves and is illustrated with a large number of views showing installations of Mazda lamps in railway cars, and also shades, reflectors and fixtures appropriate for this purpose. Bulletin 8D describes Mazda miniature and low-voltage lamps. These are made for voltages ranging from 1.5 to 20 volts and operate at efficiencies varying from as low as 0.79 to 1.5 watts per candle. Included in this list are automobile lamps, general battery lamps, novelty battery lamps and large low-voltage lamps for various classes of service. The bulletin gives complete data on these units and is illustrated with full-size cuts of many of the lamps, showing the shape of the filament, and the styles of base and bulb that can be procured.

The Independent Electric Manufacturing Company, Milwaukee, Wis., has completed a new factory and moved all its equipment and stock into the new quarters. The building is located on the south side of the city and is one of the most complete and up-to-date factories for the manufacture of

starting and controlling devices in the country. Before building, the company spent considerable time in thoroughly investigating many modern manufacturing plants and has endeavored to build a shop combining many new features. The building is constructed of concrete and brick, both sides being fitted with a large number of steel-frame windows giving ample light throughout the entire floor space. Special attention has been paid to the experimental and test rooms, the latter being equipped with several motor-generator sets, so that many variations of voltage may be obtained for testing direct-current apparatus, and transformers have been installed for the different alternating-current voltages. Easements have been obtained from the adjoining railroad company for a siding across the property and a switch track will be constructed to the shipping-room door next spring. The property on which the new factory is built is located on the Kinnickinnic River, making it possible to ship and receive by water when necessary, as well as by rail. The new mail address is 886 Greenbush Street.

General Electric Company, Schenectady, N. Y., announces that among many orders for railway equipment recently received, were the following: Nashville Railway & Light Company, Nashville, Tenn., 12 GE-88, 40-horsepower, double-end, two-motor car equipments; United Railways Company, San Francisco, Cal., 65 GE-216, 50-horsepower, four-motor car equipments; Birmingham, Ensley & Bessemer Railroad Company, Birmingham, Ala., 15 GE-210, 50-horsepower, four-motor car equipments, also two 500-kilowatt rotary converters, six 165 kilowatt transformers and switchboard for substations; Virginia Railway & Power Company, Richmond, Va., 22 Sprague-General Electric type-MK control equipments (this is the new type of simplified controller recently developed by the General Electric Company which embodies the inherent characteristics of the well known type-M all-electric control, but is lighter and more compact, being designed specifically for use on city cars); United Railways Company, St. Louis. Mo., substation apparatus, comprising seven 2,000-kilowatt rotary converters, 14 transformers (8 of 2,200, 5 of 1,500, and one of 1,100-kilowatt capacity) and switchboards; Washington Railway & Electric Company, Washington, D. C., 40 GE-200 38-horsepower four-motor car equipments; New York Central & Hudson River Railroad Company. 55 GE-69, 200-horsepower, two-motor car equipments to be installed on local cars operating on the electrified section of the road out of New York City, 30 of the equipments to be employed for converting trail cars into motor cars.

Record of Electrical Patents.

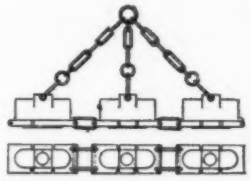
Issued by the United States Patent Office, December 24, 1912.

1,047,917. Railway-Signaling System. C. J. Coleman, New York, N. Y., assignor to Hall Switch & Signal Co. The sources of signaling current are connected across gaps in the track-bond system.

1,047,935. Switch Handle. M. Guett, assignor to Hart & Hegeman Manufacturing Co., Hartford, Conn. A recessed porcelain body with yoke and spring arms.

1,047,954. Magnetic Lifting Appliance. G. Kröhne, Duisburg, Germany. A number of magnet units are mechanically connected in a row and chains connect them to a common hoisting cable.

1,047,955. Means for Regulating Polyphase Commutator Machines. J. L. La Cour, Vesteras, Sweden. Has a



1,047,954.—Lifting-Magnet Group.

direct-current armature connected through the commutator and brushes to an auxiliary and adjustable polyphase stator winding.

1,047,956. System for Amplifying Electric-Current Variations. C. D. Lindridge, Providence, R. I. Includes ionized-gas resistances in the local circuit.

1,047,959. Blower-Unloading Device. J. G. Maclaren, assignor to Lamson Consolidated Store Service Co., Newark, N. J. Includes an electrically controlled valve so that the blower may be driven by a constant-speed motor.

1,047,960. Ventilating Device. A. Malinovszky, Schenectady, N. Y., assignor of one-half to J. J. Urschel. Escape of gas from a small vent controls an electric ventilating outfit and alarm.

1,047,963. Timing Device for Ignition Systems. C. T. Mason, Sumter, S. C. A collar and sleeve on the magneto-armature shaft acts as a timer.

1,047,973. Illuminated Sign. L. H. Moise, San Francisco, Cal. Channeled letters have shading attachments.

1,047,976. Sound-Recording Apparatus. J. Noll, New York, N. Y., assignor of one-half to E. Del Mar. A stretched metal band carrying a stylus is controlled by an electromagnet.

1,047,995. Process of Etching Plates by Electricity. E. G. Schwuchow and G. F. Johnston, Chicago, Ill. A resisting image is applied to the plate and then it is etched in an electrolyte of salt and sal ammoniac solution.

1,048,001. Attachment Plug or the Like. J. C. Smith, Oak Park, Ill., assignor of one-half to R. H. Rice. The body has an extension at one end forming a shoulder.

1,048,003. Means for Regulating Electric Lamps. H. S. Stone, Boston, Mass. A tube contains resistance units that can be cut in or out of circuit.

1,048,006. Dynamo-Electric Machine. M. E. Thompson, Ridgway, Pa. Relates to the arrangement of the main poles and interpoles.

1,048,017. Incandescent Lamp. T. A. Willard, Cleveland, O. A headlight with a bulb having two lamp filaments, one in and another out of the focus of the parabolic reflector.

1,048,034. Condenser Arrangement. A. R. Bullock, Cleveland, O. Five condensers are arranged as a parallelogram with diagonal and specially connected by a commutating device.

1,048,066. Guard for Overhead Trolley Wires. A. Gergely, Milwaukee, Wis. On each side of the trolley car is a depending barrel with a spring to which is secured a hinged guard finger.

1,048,117. Detector for Wireless Telegraphy and Telephony. R. F. Williams, Buffalo, N. Y., assignor of one-half to M. L. Failing. Describes special form of detector terminal, holder and connections.

1,048,118. Time Signal. E. W. Wilson, Trenton, N. J. At a central and several distant alarm stations are produced period electric signals.

1,048,119. Electric Switch. J. E. Wood, assignor to Pittsfield Spark Coil Co., Dalton, Mass. A lockable magneto and battery ignition circuit switch.

1,048,144. Metallurgical Furnace. C. H. Fulton and W. A. Coursen, Rapid City, S. D. An electric resistance furnace.

1,048,156. Electrolytic Meter. H. S. Hatfield, assignor to Firm of Schott

1,048,001.—Attachment Plug.

& Gen., Jena, Germany. An oblique extension of the main tube has a graduated scale.

1,048,162. Starting Ignition for Internal-Combustion Engines. G. Honold and M. Rall, assignors to Firm of Robert Bosch, Stuttgart, Germany. A storage battery provides the ignition at first.

1,048,164. Trolley Pole. E. A. Hornbostel, Jr., Des Moines, Ia. Describes the spring and pivot construction at the base of the pole.

1,048,167 and 1,048,168. Key Socket. H. Hubbell, Bridgeport, Conn. Two somewhat different forms of snap-switch construction are described.

1,048,169. Operating Attachment for Pull-Sockets. H. Hubbell, Bridgeport, Conn. To a collar on the socket is secured the pivot for a J-shaped arm

that operates the pull chain without strain on the shade.

1,048,172. Electrical Switching and Testing Device. M. R. Hutchison, Bronxville, N. Y. A cylindrical body contains a switch and polarity tester.

1,048,176. Trolley and Switch. T. P. Knowland, assignor of two-thirds to L. A. Douglass, Jeffersonville, Ind. A frame about the trolley wheel carries guard fingers and rollers.

1,048,179. Electric-Current Indicator. F. Kratz, assignor to Firm of Robert Bosch, Stuttgart, Germany. A normally interrupted buzzer circuit is connected so as to continually test the spark plugs.

1,048,200. Electrical Signalling System. W. Noble, assignor to C. Thompson and T. T. Francis, St. Louis, Mo. Includes a device to close a local circuit only when a predetermined strength of current passes in the main circuit.

1,048,205. Apparatus for Winding Armatures for Dynamos and Motors. F. N. Pike, New York, N. Y., assignor of one-third to E. N. Dickerson. The machine has an armature support and feed mechanism for intermittently rotating the support.

1,048,209. Telegraph Repeater. G. L. Rawdon, Cleveland, O. Includes a pair of receiving relays (each with a main and a differential magnet) and a repeating sounder.

1,048,223. Electromagnetic Separator. H. Stein, Cologne, Germany. The opposing poles have intercolated extensions and serrated teeth.

1,048,231. Method of Manufacturing Carborundum Filaments. F. C. Thoms, assignor to Nernst Lamp Co., Pittsburgh, Pa. A carbon core is flashed in a jar containing silicon tetrachloride, hydrogen and ethylene gases.

1,048,253. Telephone Transmitter. D. H. Wilson, assignor to D. H. Wilson and R. Bines, New York, N. Y. A double-ended transmitter with two diaphragms and carbon cups between them.

1,048,260. Trolley Guard. G. Zeller, Issaquah, Wash. Has a guard arm on each side of the wheel.

1,048,277. Thermostat. D. E. Belden, assignor to Jewell Manufacturing Co., Auburn, N. Y. Thermometric control for an electric circuit.

1,048,279. Lamp Socket. R. B. Benjamin, Chicago, Ill. A lamp grip includes two spring friction shoes bearing against the lamp base to prevent the lamp becoming loose from vibration.

1,048,284. Means for Insulating Rail Joints. B. G. Braine, assignor to Rail Joint Co., New York, N. Y. A section of insulation is removably clamped to the outer side of the joint bar.

1,048,302. Ignition System. F. R. Dominguez, El Rio, Cal. Includes a special switch.

1,048,314. Trolley Head. O. N. Iverson, Hills, Minn. Special guard arms on each side of the wheel.

1,048,349. Temperature Alarm. C. F. Rumold, J. P. Faulkner and J. W. Dinsmore, Berea, Ky. Includes electric signals, primary and secondary circuits.

1,048,362. Starting Internal-Combustion Engines. F. R. Simms, assignor to Simms Magneto Co., New York, N. Y. A special electric ignition system, a storage battery acting as source at first, then the magneto.

1,048,366. Electromagnetic Switch. J. C. Smith, Louisville, Ky. The armature moves the contactor.

1,048,372. Automatic Fire-Lighter. E. N. Swan and A. Beightol, Scotia, Cal. A push-button adjoining the bed controls an electric match igniter in the stove.

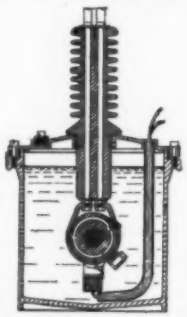
1,048,377. Shade-Holder. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. The lamp socket has a bead threaded on its crown to engage the shade-holder.

1,048,390. Insulator. F. Brown, Laketon, Mich. Has a wire-receiving slot over which a cap is threaded.

1,048,419. Controller. A. L. Loguin, assignor to Allis-Chalmers Co., West Allis, Wis. The movable contact member can be locked in operative position.

1,048,432. Motor-Control System. J. C. Smith, Louisville, Ky. Includes special resistance - short - circuiting switches.

1,048,433. X-Ray Tube. J. H. Snively, Seattle, Wash. Sealed to the wall of the tube is a lead-glass cone with



1,048,436.—High-Tension Current Transformer.

its apertured apex near the focal point of the cathode stream.

1,048,436. Electric Current Transformer. E. C. Wescott, Sacramento, Cal. The primary leads pass through a high-tension bushing that supports the element in the oil tank.

1,048,439. Electrically Actuated Railway Switch. J. H. Baker, Henderson, Ill. Is motor-operated when a special track circuit is closed.

1,048,443. Telephony or Telegraphy. S. G. Brown, London, Eng. A relay in which the current traversing a pair of contacts maintains a minute conduction space between them.

1,048,445. Indicator. L. M. Coventry, Adelaide, S. A. Australia. Electrically actuated clockwork moves a display band in either direction.

1,048,446. Automatic Package Filler and Weigher. J. P. Curry, New York, N. Y. The package is slightly overfilled and then the surplus is electrically withdrawn until the scale shows the proper weight.

1,048,450. Current-Controlling Apparatus. E. L. Gale, Sr., assignor to Otis Elevator Co., East Orange, N. J. An automatic motor starter with electromagnetic switch and controller.

1,048,466. Horn. W. Sparks, Jackson, Mich. Has an electric-motor-driven vibrating diaphragm.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 31, 1912:

552,093. Signaling System. H. Bezer, New Rochelle, N. Y.

552,094. Automatic Electric Switch. H. H. Blades, Detroit, Mich.

552,103. Multipolar Electromagnet. W. P. Daniels, Cologne, Germany.

552,105. Apparatus for Automatically Maintaining Current Upon Moving Vehicles. H. E. Dey, Brooklyn, N. Y.

522,166. Electric Thermostat and Push-Button. O. F. Woodward, Le Roy, N. Y.

552,172. Electromagnetic Mechanism. S. D. Field, Stockbridge, Mass.

552,173. Electric Telephone. S. D. Field, Stockbridge, Mass.

552,181. Electrical Railway-Signaling Apparatus. H. J. Hovey, Evanston, Ill.

552,190. Electric Arc Light. L. B. Marks, New York, N. Y.

552,211. Depolarizer for Primary Batteries and Method of Making Same. G. W. Thurnauer, Aurora, and M. M. Kohn, Chicago, Ill.

552,218 to 552,220. Electric Battery. D. S. Williams, Philadelphia, Pa.

552,239. Safety Device for Electric Circuits. P. H. D'Unger, Chicago, Ill.

552,260. Apparatus for Transforming Alternating Currents into Unidirectional Currents. C. Pollak, Frankfort, Germany.

552,271. Electrical Bicycle. O. Bolton, Jr., Canton, O.

552,279. Electric Signal for Railways. E. B. Cutten, New York, N. Y.

552,309. Electric Meter. J. R. Tucker, and C. C. Hinckley, Aurora, Ill.

552,313. Synchronous Single-Phase Motor. C. E. L. Brown, Baden, Switzerland.

552,316. Electrical Railway-Signaling System. T. B. Dixon, Henderson, Ky.

552,322. Secondary Battery. A. S. Krotz, and W. W. Spencer, Springfield, O.

552,337. Electric Motor. A. W. Smith, Washington, D. C.

552,338. Electrical Rail-Fish. V. Thelin, Geneva, Switzerland.

522,341. Electric Smelting Furnace. J. A. Vincent and J. E. Hewes, Philadelphia, Pa.

552,369. Means for Operating Electric Railway Vehicles. E. G. W. C. Hoffmann, Charlottenburg, Germany.

552,371. Method of and Apparatus for Measuring Illumination. E. J. Houston and A. E. Kennelly, Philadelphia, Pa.

552,384. Electric Gas-Lighter. P. Meyer, Alameda, Cal.

552,397. Regulator for Dynamos. C. E. Scribner, Chicago, Ill.

552,420. Signaling and Lock-Out Apparatus for Telephone Stations. J. D. Clarke, Chicago, Ill.

552,425. Secondary Battery. C. A. Faure, Paris, France, and F. King, London, Eng.

552,451. Electric Railway. M. H. Smith, Halifax, Eng.

552,469. Double-Diaphragm Telephone Transmitter. D. Drawbaugh, Eberly's Mill, Pa.

552,477. Rail-Bond for Electric Railways. B. J. Jones, Chicago, Ill.

552,479. Electrical Rail-Bond. M. K. Kendall, Melrose, Mass.

552,495. Regulator for Electrical Circuits. J. C. Mayrhofer, New York, N. Y.

552,496. Electric Lighting System. J. C. Mayrhofer, New York, N. Y.

552,498. Electric Arc Incandescent Lamp. J. A. Mosher, Chicago, Ill.

552,501. Insulator. Charles H. Snively, Mount Carmel, Pa.

Electric Wagon Section

A Central-Station Opportunity—Electric Wagon Specifications.

By Henry Farrington, Editor of "The Power Wagon."

The central station that neglects the electric wagon is not only losing a splendid opportunity to gain new and profitable business; it is actually making for itself a situation that will result in the loss of many of the most important customers it has at present.

This statement is based on cold logical facts that will presently be disclosed, and is made out of a thorough knowledge of road transportation and business conditions of the present day—and the writer has no partiality either to the central station in particular or to the electrical industry at large.

There are in use today in the United States not less than 55,000 motor wagons of all kinds. Of these, only 6,000, or rather more than 10 per cent, are electrics. Assuming that all of the 50,000 gasoline machines would have been installed in any case, the number of electric wagons in this country should be in the neighborhood of 33,000, considering the numerical relation the electric bears to the gasoline truck in the work it can economically perform. And the chief cause why this number is not in use is the unexplainable apathy of the central station, with a few notable exceptions.

Expressed in terms of their earning capacity to the man who has electric current for sale, the 6,000 electric wagons now in service use about two million dollars' worth of electricity per year, while 33,000 would mean a yearly revenue of $11,000,000, these figures being based on an average charge of four cents per kilowatt-hour.

Most of these 6,000 electric wagons are employed in a very few of the large cities. New York City has 1,500. Chicago has 425. Philadelphia, Boston, Washington, Baltimore, St. Louis, Rochester, Providence, Indianapolis, Cleveland, Detroit and St. Paul contribute about 50 per cent of the remainder.

In hundreds of thriving American cities and towns, electric wagons are as scarce as aeroplanes. Even in so important a place as Salt Lake City there is but one solitary electric wagon which, on account of the poor adaptation for the work it is doing, has made an indifferent showing. Yet in New York City, where the local Edison company is taking a keen interest in the electric wagon, there are 18 concerns using fleets of 25 or more electrics, nine with 50 or more, four with 100 or more, and one company using no less than 215 of these unobtrusive, silent-running and highly economical power wagons.

The importance of the electric wagon as a new business asset to the central station is apparent by the fact that the average machine now in service consumes about 750 kilowatt-hours of energy per month. The average householder in this country buys not more than 30 kilowatt-hours per month. Therefore, each machine is equivalent to 25 houses in current consuming capacity. And an installation of 10 electric wagons means about the same thing as the addition of 250 new houses to the company's mains.

But there is one important difference, and one that cannot be too highly emphasized, between these kinds of new business. The electric-wagon demand comes as an off-peak load, whereas the addition of new lighting customers involves the installation of extra generating capacity to take care of the increase in the peak load. With 250 extra house customers, this new generating capacity would be from 20 to 50 kilowatts—depending, of course, on the diversity. There would also be the expense of providing pole or conduit lines to the customers' premises. For charging power-wagon storage batteries, however, the number of extra service lines would be much less, the additional generating capacity negligibly small or nothing at all, and, except in the case of alternating-current stations where motor-generators or rectifiers would be needed, there would be no charge for new apparatus other than a few meters and an extra panel or so on the switchboard.

These considerations show the importance of the new business feature of the electric wagon to the central station. But there is also the menace of possible loss of present business to the electric generating company that does not make provision for the electric business vehicle.

Recently, in one of the largest cities of the country, a big concern using thousands of dollars' worth of current a year asked the local central station for special facilities for taking care of a fleet of electric wagons. The request was unusual, and the desired facilities were denied. The result was that the company in question immediately gave orders for the construction of a large isolated plant sufficiently large

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to provide electric generating capacity for all its present and future lighting and power requirements, including those of its contemplated electric-wagon installation.

That particular central station will not make the same mistake again, for the customer was a big one and the lesson thus taught has been well learnt. But if the total revenue involved had been comparatively small it is quite probable that a good many chances would have been passed up before the central station perceived its mistake.

The present time is a highly crucial one for the central stations to take active notice of their opportunities in regard to the electric-wagon business. Well inside of ten years from the present, this country will be buying motor trucks at the rate of 200,000 a year. Of these, forty per cent, or 80,000, should be electric wagons, with a total earning capacity to the central stations of over $25,000,000 each year. No wonder, then, that Thomas Alva Edison predicts the electric wagon will form eventually the greatest single revenue-producer to the central station. And if the central station does not take advantage of this great opportunity, the isolated plant will appropriate what business is left after the gasoline and other forms of motor wagons have had their innings.

This brings up another subject—the relation of the electric to the gasoline and other types of power wagon.

No up-to-date and well-informed business man, be he the most rabid electric partisan, will make the mistake of opposing the introduction of the gasoline truck. For every one electric wagon now being made, there are nine gasoline trucks being put into service. And yet, if the electric people were to have what is due them, they should have forty per cent of the motor-wagon business in the large centers of population. They will gain nothing, however, by decrying the non-electric power wagons. Rather, they should boost all motor vehicles. Properly adapted for the work they have to perform, they are all better than the horse in point of economy and serviceability. Only when the horse wagon is displaced from its present ascendancy should there be a discussion over types and engineering.

There is plenty of room for the electric wagon. For short hauls, or for service with many stops and starts in the course of a day's work, it is usually the best of all road vehicles. This is its principal field, and no well-wisher of electric road transportation would encourage the use of the electric wagon in services where the gasoline truck or the horse vehicle will show greater economy. If a central station has need of many road vehicles in its own service, it should choose the electric wagon only for the work in which it will show to the best advantage, and gasoline or horse trucks for the rest. Then, if it needs an object lesson of electric wagon economy, it can produce its own service records to the best advantage.

There are several ways in which the central station may take care of the electric wagon in its territory.

(1) It can establish reduced rates for storage-battery charging in off-peak periods.

(2) It can undertake the garaging and charging of electric vehicles.

(3) It can superintend the conversion of garages and stables for electric-vehicle garaging and charging, including the installation of special apparatus and the establishment of preferential rates.

(4) It can lease, maintain and charge storage batteries for electric vehicles, thus converting a large part of a customer's fixed charges into maintenance and operating expense spread over a long period and therefore less likely to be burdensome on small concerns. The charge for such service would be on a combination time and mileage, or time and amperage basis.

With the possible exception of the last method—which is suggested by the writer to encourage the smaller concerns to use electric wagons—all of these systems are being profitably used by one or another of a few of the more enterprising central stations throughout the country. But there are hundreds, if not thousands, of electric generating companies that could materially add to their profits by looking after the electric wagon.

For those central stations which are not acquainted with electric-wagon practice—and this means all but a very few—the specification tables on the following pages have been specially compiled. These show the electrical and mechanical features of all the best electric motor wagons on the American market, and form an efficient and necessary aid to expert buying, selection and adaptation.

AVERAGE MONTHLY CONSUMPTION OF CURRENT FOR ELECTRIC MOTOR WAGONS IN UNITS OR FLEETS.

No. Trucks	Miles per day.	½ Ton K.W.H.	1 Ton K.W.H.	2 Ton K.W.H.	3½ Ton K.W.H.	5 Ton K.W.H.
1.....	40	437	515	685	856	1,028
1.....	30	330	388	520	650	780
1.....	25	286	338	443	560	675
1.....	20	245	286	377	482	572
1.....	15	218	258	354	430	520
5.....	40	2,185	2,580	3,430	4,280	5,140
5.....	30	1,550	1,940	2,610	3,250	3,900
5.....	25	1,430	1,690	2,220	2,800	3,380
5.....	20	1,225	1,430	1,890	2,410	2,860
5.....	15	1,090	1,290	1,770	2,150	2,600
10.....	40	4,370	5,150	6,850	8,560	10,280
10.....	30	3,300	3,880	5,200	6,500	7,800
10.....	25	2,680	3,380	4,430	5,600	6,750
10.....	20	2,450	2,860	3,370	4,820	5,720
10.....	15	2,180	2,580	2,540	4,300	5,200
20.....	40	8,740	10,300	13,700	17,120	20,520
20.....	30	6,600	7,760	10,400	13,000	15,600
20.....	25	5,360	6,760	8,860	11,200	13,500
20.....	20	4,900	5,720	6,740	9,640	11,440
20.....	15	4,360	5,160	6,080	8,600	10,400
50.....	40	21,850	25,800	34,300	42,800	51,400
50.....	30	16,500	19,400	26,100	32,500	39,000
50.....	25	14,300	16,900	22,200	28,000	33,800
50.....	20	12,250	14,300	18,900	24,100	28,600
50.....	15	10,900	12,900	17,700	21,500	26,000
100.....	40	43,700	51,500	68,500	85,600	102,800
100.....	30	33,000	38,800	52,000	65,000	78,000
100.....	25	26,800	33,800	44,300	56,000	67,500
100.....	20	24,500	28,600	33,700	48,200	57,200
100.....	15	21,800	25,800	25,400	43,000	52,000

WALKER ELECTRIC MOTOR TRUCKS

THERE is no longer any question but that the work of hauling can be done more economically, everything considered, by power-driven than by horse-drawn vehicles.

Neither is there longer any question as to the merit of the Electric Commercial Vehicle. On the contrary, it is a fact that leading merchants in all lines, the country over, have set their seal of approval upon the Electric as being pre-eminently fitted to give them more of the things they want than any other vehicle.

THE THING THE USER WANTS. Briefly, it is the ability of his trucks or wagons to do all the work assigned to them Economically and Continuously, day after day and year after year.

IN THESE ESSENTIALS, and in all others WALKER ELECTRICS are successfully meeting the requirements of the most exacting users.

We will be glad to confer with you regarding *your* delivery needs — large or small.

Walker Vehicle Company

Main Office and Factory, Chicago

New York Office, 30 Church Street **Boston Office, 131 State Street**

Representatives in all principal cities

INDEX AND KEY TO ELECTRIC WAGON SPECIFICATIONS

Electric Truck Manufacturers

1. Anderson Electric Car Company, Detroit, Mich.
2. Argo Electric Vehicle Company, Saginaw, Mich.
3. Atlantic Vehicle Company, 1600 Broadway, New York City.
4. Baker Motor Vehicle Company, Cleveland, Ohio.
5. Commercial Truck Company of America, Twenty-seventh and Brown Streets, Philadelphia, Pa.
6. Couple-Gear Freight-Wheel Company, Grand Rapids, Mich.
7. General Motors Truck Company, Pontiac, Mich.
8. General Vehicle Company, Long Island City, N. Y.
9. Lansden Company, The, 233 High Street, Newark, N. J.
10. Ward Motor Vehicle Company, St. Mary's and Concord Streets, New York City.
11. Waverley Company, Indianapolis, Ind.

Electric Truck Parts and Accessory Makers Alphabetical List

1. American Ball Bearing Company, Cleveland, Ohio. (Axles, Differentials.)
2. Bayard, M. L., & Company, Woodbine, N. J. (Steering Gears.)
3. Bohl & Sires. (Warning Signals.)
4. Brown-Lipe Gear Company, Syracuse, N. Y. (Differentials.)
5. Cullman Wheel Company, 1340 Greenwood Terrace, Chicago. (Differentials.)
6. Cutler-Hammer Manufacturing Company, Milwaukee, Wis. (Controllers.)
7. Diamond Chain and Manufacturing Company, Indianapolis, Ind. (Chains.)
8. Edison Storage Battery Company, Orange, N. J. (Storage Batteries.)
9. Electric Storage Battery Company, Philadelphia, Pa. (Storage Batteries.)
10. Firestone Tire and Rubber Company, Akron, Ohio. (Tires.)
11. Gemmer Manufacturing Company, Detroit, Mich. (Steering Gears.)
12. General Electric Company, Schenectady, N. Y. (Controllers, Motors.)
13. Gibney Tire and Rubber Company, Conshohocken, Pa. (Tires.)
14. Gill & Sons, P. H., Forge and Machine Works, Lorraine and Otsego Streets, Brooklyn, N. Y. (Axles.)
15. Goodrich Company, B. F., Akron, Ohio. (Tires.)
16. Goodyear Tire and Rubber Company, Akron, Ohio. (Tires.)
17. Morse Chain Company, Ithaca, N. Y. (Chains.)
18. Motz Tire and Rubber Company, Akron, Ohio. (Tires.)
19. Renold, Hans, Ltd., Progress Works, Manchester, England. (Chains.)
20. Ross Gear and Tool Company, LaFayette, Ind. (Steering Gears.)
21. Spicer Manufacturing Company, Flainfield, N. J. (Universal Joints.)
22. Timken-Detroit Axle Company, Detroit, Mich. (Axles, Differentials.)
23. United States Light and Heating Company, 30 Church Street, New York City. (Storage batteries.)
24. Warner Manufacturing Company, Toledo, Ohio. (Steering Gears.)
25. Western Electric Company, Chicago. (Warning Signals.)
26. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. (Motors, Controllers.)
27. Whitney Manufacturing Company, Hartford, Conn. (Chains.)

Electric Truck Parts and Accessory Makers Classified List

MOTOR:
General Electric Company, Schenectady, N. Y.
Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

BATTERY:
Electric Storage Battery Company, Philadelphia, Pa.
Edison Storage Battery Company, Orange, N. J.
U. S. Light and Heating Company, 30 Church Street, New York City.

CONTROLLER:
Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
General Electric Company, Schenectady, N. Y.
Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

CHAIN (silent):
Morse Chain Company, Ithaca, N. Y.
Renold, Hans, Ltd., Progress Works, Manchester, England.

CHAIN (driving):
Diamond Chain and Manufacturing Company, Indianapolis, Ind.
Whitney Manufacturing Company, Hartford, Conn.

DIFFERENTIAL:
American Ball Bearing Company, Cleveland, Ohio.
Brown-Lipe Gear Company, Syracuse, N. Y.
Cullman Wheel Company, 1340 Greenwood Terrace, Chicago.
Timken-Detroit Axle Company, Detroit, Mich.

UNIVERSAL JOINT:
Spicer Manufacturing Company, Flainfield, N. J.

JACKSHAFT:
Timken-Detroit Axle Company, Detroit, Mich.

STEERING GEAR:
Bayard, M. L., & Co., Woodbine, N. J.
Gemmer Manufacturing Company, Detroit, Mich.
Ross Gear and Tool Company, Lafayette, Ind.
Warner Manufacturing Company, Toledo, Ohio.

AXLE:
American Ball Bearing Company, Cleveland, Ohio.
P. H. Gill & Sons Forge and Machine Works, Lorraine and Otsego Streets, Brooklyn, N. Y.

WARNING SIGNAL:
Buhl & Sires, Detroit, Mich.
Western Electric Company, Chicago.

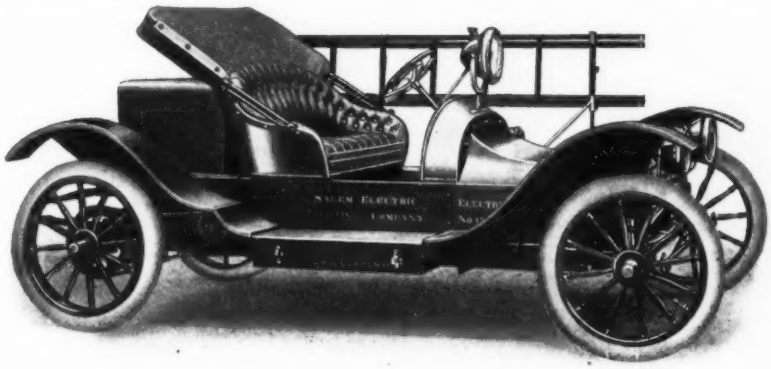
TIRE:
Firestone Tire and Rubber Company, Akron, Ohio.
Gibney Tire and Rubber Company, Conshohocken, Pa.
B. F. Goodrich Company, Akron, Ohio.
Goodyear Tire and Rubber Company, Akron, Ohio.
Motz Tire and Rubber Company, Akron, Ohio.

Bailey Electric Roadster

Edison Battery

Especially Designed for

Electric Light and Power Companies



Roadster Adapted for Street Arc Lamp Trimming and Patrol Service

The large box back of the seat serves to carry arc lamp globes, carbons, etc., and on the inside is 32 inches long, 23¼ inches wide and 16⅞ inches high. Felt lined compartments to suit.

Each running board box measures inside 35 inches long, 12 inches wide and 5¼ inches high.

The car can be equipped as shown with irons for carrying extension ladder and with search-light on swivel bracket on dashboard.

The battery capacity, the speed and mileage can be varied to suit requirements

BOSTON EDISON CO.'S TEST OF FAST ROADSTER, JUNE 11, 1912
ONE CHARGE OF BATTERY

103.2 miles in 5 hours, 7½ minutes
Average speed 20.14 miles per hour

Route.—Boston to Pawtucket, R. I., and return (78 miles), remainder of run about Boston

OTHER RECENT RUNS
SHOWING HIGH AVERAGE SPEED OBTAINABLE

Nov. 20, '12, Springfield, Mass., to Hartford, Conn., 28.4 miles, in 1 hour 21 minutes.
Average speed, 21.0 miles per hour.
Hartford, Conn., to Springfield, Mass., 26.9 miles, in 1 hour 17 minutes.
Average speed, 21.0 miles per hour.
Nov. 21, '12, Springfield, Mass., to Worcester, Mass., 52.9 miles, in 2 hours 36 minutes.
Average speed, 20.3 miles per hour.
Worcester, Mass., to Boston, 42.6 miles, in 2 hours 1 minute.
Average speed, 21.1 miles per hour.
Dec. 11, '12, Boston to Lowell, Mass., 25.9 miles, in 72 minutes.
Average speed, 21.6 miles per hour.

The first Bailey Roadster was brought out in the winter of 1911-1912, and the following are electric light companies which have placed orders up to date:—

Edison Electric Illuminating Co., of Boston. (16)
Malden Electric Co., Malden, Mass. (3)
Haverhill Electric Co., Haverhill, Mass.
Franklin Electric Light Co., Turners Falls, Mass.
Minneapolis General Electric Co., Minneapolis, Minn.
Omaha Electric Light & Power Co., Omaha, Neb.
Stamford Gas & Electric Co., Stamford, Conn.
Salem Electric Lighting Co., Salem, Mass.
Commonwealth Edison Co., Chicago. (2)
Montreal Light, Heat & Power Co., Montreal.
Concord Municipal Light Plant, Concord, Mass.
Lynn Gas & Electric Light Co., Lynn, Mass.
Cambridge Electric Light Co., Cambridge, Mass.
New Bedford Gas & Edison Light Co., New Bedford, Mass.
Harrisburg Light & Power Co., Harrisburg, Pa.
Blackstone Valley Gas & Electric Co., Pawtucket, R. I.
Edison Electric Illuminating Co., of Brockton, Mass.
Commonwealth Water & Light Co., Summit, N. J.

The Bailey Car has a remarkable suspension, simplest possible control, low center of gravity, extreme accessibility of parts and a simple and durable construction

S. R. Bailey & Co., Inc., 895 Boylston St., Boston

Factory at Amesbury, Mass.

The Weeding Out Process

You don't have to figure out the economics behind the forced vacation of the horse. You know it already, only you don't think of it. For instance:

Nature believes in the weeding out process. Sixty pine seedlings start growing in a grove. In a few years there are fifty, then forty, and finally about twenty of the strongest survive. It is a case of having twenty real trees or sixty stunted saplings not fit for box "shooks."

In the industrial world, the best machines or tools survive because of the weeding out process. Not only that, but one improved machine usually speeds up all the other processes identified with the manufacture or transportation of a given product.

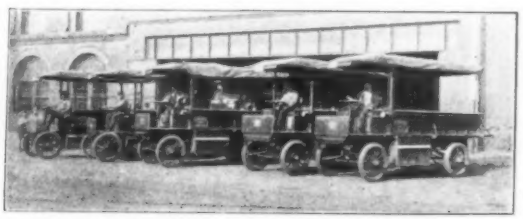
Until we had the Motor Truck we didn't know how inefficient and wasteful were our methods of delivery with horseflesh. **The horse was efficient only so long as other methods of transportation were on par with him.** With the telephone, the 20th Century Limited, and the Automobile the trackless delivery of merchandise had to be speeded up to keep pace with other things. **The horse couldn't be speeded up,** so he had to be **weeded out.** Of the city at least.

The elimination of the waste has behind it a law as immutable as death itself. We retain the incompetent at an awful price. We get the stunted tree, the deferred dividend, the ox cart on Broadway.

On the 18th of November, we received an order for sixteen more G. V. Electrics for Manila, which will give us 39 there. In Manila is the slow plodding carabao and wooden cart, which is eliminated, but the principle is the same.

You can argue until you are black in the face that Electric Trucks are not perfected, but that won't prevent the sale of Some Ten Million Dollars' worth in 1913 to satisfied customers. It won't prevent the horse from eating into the pocket of the firms you already sell current to, nor will it flatten out your load curve.

Let's get together.



Eight G. V. Eletcric Trucks used by Adams Express Company. This Company has 137 G. V. Trucks in its service in nine cities. "The Consolidated" of Baltimore garages twenty-two for the American Express Company.

Filling in the Night Valley

We have tried to show you why, in speeding up deliveries, the horse just naturally **must be eliminated.** Deliveries are always increasing, so an expanding market for Motor Trucks is assured. In the cities, especially, the Electric Truck will predominate. It does already.

It is charging Electric Trucks and Wagons, and this only, which will fill in your night valley. G. V. Trucks work 300 days a year.

Flat Irons make Tuesday's curve look good, but there's only one Tuesday in a week. Fans are only good for about three months a year. Even your motor load earns little on a heavy plant investment. The Electric Truck nestles right up close to saloon lighting as a pro-rata profit maker and don't you forget that **you get the business at night.**

Remember how dubious every one was about the first typewriter? How big the price looked and how revolutionary the whole idea was? Let us put one little G. V. Wagon in your service and you'll swear at the first man that wants to take it out long enough to paint it.

And when you get a dozen G. V. Trucks from **outside** taking nourishment from those buses of yours, you'll rub your eyes at the flattening curve and still more at the balance sheet.

G. V. Electrics are made in six capacities, 750 lbs., 1,000 lbs., 2,000 lbs., 2 tons, 3½ tons and 5 tons. They are used by 103 Central Stations and by merchants, express companies and others who together operate thousands of them. We are obliged to treble production facilities for 1913.

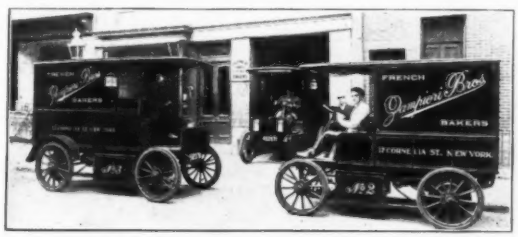
SPECIAL NOTICE:—We have first hand information on the comparative costs of Electric Trucks, Gasolene Trucks and Horses in about any large line of business you can mention. A LIMITED NUMBER of sets will be made up for Central Station Officials. Write to Dept. C. S.

Catalogue 85 on request.

The General Vehicle Company, Inc.

Principal Office and Factory: Long Island City, New York

New York Chicago Boston Philadelphia St. Louis Minneapolis Cincinnati



A "horseless" baker. All horses and wagons sold and stable torn down in thirteen months, and four G. V. Electrics and garage substituted. The first G. V. 750 pound Wagon increased business on its route 25 per cent. Current from New York Edison Company.

Brand or Trade Name (Number in parenthesis refers to Key, page 60, showing name and address of manufacturer).	Normal load rating, in pounds.	List price of stripped chassis, including seat and tires.	Weight of stripped chassis, including *both* seat and tire equipment.	POWER PLANT																	
				MOTOR									BATTERY								
				Type (Series-wound)	Voltage	Location (Amidships, Back axle, Front wheels, Rear wheels, 4 wheels)	Number of motors	Horsepower of each motor	Revolutions per minute of motor at normal speed	Total horsepower of all motors at maximum overload	Maker of motor (The number refers to a key on page 60)	Weight	Location (under Body, Driver's seat, Hood, Passengers' seats, or over Frame behind driver)	Number of cells	Number of plates in each cell	Electrolyte (Alkaline, or Sulphuric acid and water)	Mileage full load, full speed	Mileage half load, full speed	Maker's brand name of battery	Maker of battery (The number refers to a key on page 60)
Baker (4)	500		$1700	S	60	A	1	2	1800	8	12	....	DH	30	..	S	..	..	..	..
C. T. (5)	500	$1795	2650	S	85	B	1	1.8	1500	5.4	12	1050	B	42	..	S	..	..	..	..
G. V. (8)	750	1080	2460	S	85	R	1	1.75	1600	1.75	O	835	B	44	9	S	45	..	..	O
Argo (2)	1000	1700	2400	S	80	B	1	2.5	1500	12.5	26	1160	B	40	11	S	40	45	..	9
Baker (4)	1000	....	2700	S	84	A	1	2.5	1800	10	12	....	B	42	..	S	..	..	..	..
C. T. (5)	1000	2050	2790	S	85	B	1	2.5	1200	7.5	12	....	B	42	..	S	..	..	..	..
Detroit (1)	1000	2345	2260	S	70	A	1	3.5	1300	10	O	850	B	60	9	A	45	55	A4	8
G. M. C. (7)	1000	1385	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
G. V. (8)	1000	1370	3090	S	85	R	1	2	2000	2	12	1255	B	44	11	S	45	45	..	O
Lansden (9)	1000	....	....	S	60	A	1	3	1200	12	12	840	B	60	9	A	50	60	A4	8
Ward (10)	1000	....	....	S	84	A	1	....	1800	....	12	....	B	42	..	S	45	..	..	..
Waverley (11)	1000	1800	2975	S	85	B	1	4	1200	....	O	1120	B	42	11	S	50	65	..	..
Argo (2)	2000	2100	3200	S	80	B	1	2.75	1500	15	26	1300	B	40	13	S	40	45	..	9
Atlantic (3)	2000	2400	4400	S	..	..	1	....	....	....	12	....	B	44	..	S	55	..	..	9
Baker (4)	2000	....	3400	S	84	A	1	3.5	1200	14	12	....	B	42	..	S	..	..	..	..
C. T. (5)	2000	2625	3750	S	85	R	2	1.8	1500	11	12	1600	B	42	..	S	..	..	..	..
Detroit (1)	2000	2870	2900	S	70	A	1	3.5	1300	10	O	1260	B	60	13	A	50	60	A6	8
G. M. C. (7)	2000	1485	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
G. V. (8)	2000	1710	3985	S	85	R	1	3	1200	3	12	1485	B	44	13	S	45	..	..	O
Lansden (9)	2000	....	....	S	60	A	1	4	1000	16	12	1200	B	60	13	A	50	60	A6	8
Ward (10)	2000	....	....	S	84	A	1	....	1750	....	12	....	B	42	..	S	40	..	..	..
Waverley (11)	2000	2250	3750	S	85	B	1	4.5	1170	....	O	1300	B	42	15	S	50	65	..	..
G. M. C. (7)	3000	1685	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
Atlantic (3)	4000	3000	5700	S	..	..	1	....	....	....	12	....	F	44	..	S	55	..	..	9
Baker (4)	4000	....	5300	S	84	A	1	4	1200	16	12	....	B	42	..	S	..	..	..	..
C. T. (5)	4000	3375	5015	S	85	R	2	2.5	1200	15	12	2100	B	42	..	S	..	..	..	..
G. M. C. (7)	4000	1980	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
G. V. (8)	4000	2090	5530	S	85	R	1	3	1200	3	12	1970	B	44	17	S	45	..	..	O
Lansden (9)	4000	....	....	S	60	A	1	5	1100	20	12	1600	B	60	17	A	40	50	A8	8
Ward (10)	4000	....	....	S	84	A	1	....	1200	....	12	....	B	42	..	S	35	..	..	..
Waverley (11)	4000	3000	6300	S	85	B	1	5	1200	....	12	1600	B	42	17	S	45	55	..	..
Atlantic (3)	6000	3500	7700	S	..	..	1	....	....	....	..	....	B	44	..	S	45	..	..	..
G. M. C. (7)	6000	2280	....	S	..	R	2	....	....	....	12	....	D	44	..	..	..	..	..	..
Baker (4)	7000	..	7500	S	84	A	1	5	1200	20	12	....	B	42	..	S	..	..	..	..
C. T. (5)	7000	4320	6860	S	85	4	4	1.8	1500	22	12	2650	B	42	..	S	..	..	..	..
Couple Gear (6)	7000	4250	7500	S	100	4	4	3	1800	50	O	2600	A	44	21	S	40	45	..	23
Detroit (1)	7000	5000	8115	S	60	A	1	8	1200	24	O	2250	B	60	17	A	35	40	A10	8
G. V. (8)	7000	2620	7415	S	85	R	1	4	1200	4	12	2410	B	44	21	S	40	..	..	O
Lansden (9)	7000	....	....	S	60	A	1	6	1100	24	12	2000	B	60	21	A	40	50	A10	8
Waverley (11)	7000	3500	7250	S	85	B	1	6	1050	....	12	2300	B	42	21	S	40	50	..	..
G. M. C. (7)	8000	2630	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
Ward (10)	8000	....	....	S	84	A	1	....	850	....	12	....	B	42	..	S	30	..	..	..
Atlantic (3)	10000	4000	9200	S	..	..	1	....	....	....	..	....	F	44	..	S	40	..	..	9
C. T. (5)	10000	4805	7835	S	85	4	4	1.8	1500	22	12	....	B	42	..	S	..	..	..	..
Couple Gear (6)	10000	4800	8500	S	100	4	4	3	1500	50	O	3000	A	44	25	S	35	40	..	23
G. M. C. (7)	10000	2925	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..
G. V. (8)	10000	2950	8350	S	85	R	1	5	850	5	12	2790	B	44	25	S	35	..	..	O
Lansden (9)	10000	....	....	S	60	A	1	8	900	32	12	2400	B	60	25	A	40	50	A12	8
Waverley (11)	10000	4000	9700	S	85	B	1	6	1200	....	12	2800	B	42	25	S	35	45	..	..
G. M. C. (7)	12000	3175	....	S	..	R	1	....	....	....	12	....	D	44	..	..	..	..	..	..

NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns the letter "O" means "own."

The "Exide" Batteries
and their
INSTRUCTION BOOK

This page contains the complete Instruction Book for the care and operation of the "Ironclad-Exide", "Exide", "Hycap-Exide" and "Thin-Exide" Batteries.

It is an illustration of the *"freedom from care"* which the owners of these batteries secure There are no *"don'ts"* in these instructions.

USE PURE WATER ONLY FOR REPLACING EVAPORATION

INSTRUCTION BOOK

For the Operation of the

"Exide" Vehicle Batteries

GENERAL

Discharge

THE battery may be discharged, without injury to the plates, at any rate of current it will deliver. The battery should be promptly recharged upon reaching 1.7 volts per cell when delivering the normal service rate stamped on the name plate.

Unnecessary Charging

It is uneconomical to charge the battery more frequently than once a week unless the service requires it.

Standing Discharged

A battery should never stand completely discharged.

Caution

Keep naked flames (match, candle or lighted cigar) away from the battery at all times.

Adding Water

Keep the level of the electrolyte always above the top of the plates by replacing evaporation with pure water (never anything else) to a height of one-half inch above top of

Page 1

plates. This should be done before a charge.

CHARGING

Kind of Current

Use only direct current (never alternating current) for charging; if only alternating is available, apparatus must be procured to change it to direct.

Polarity

The positive terminal of the battery must be connected to the positive wire of the charging circuit.

Ventilation

Open the battery compartment; ventilation on charge is necessary.

Charging Rates

The charge for any of the batteries of the "Exide" family may be started at any available rate of current within the capacity of the charging apparatus, wiring and connections.

Wide Range of Rates

The only limitations of the charging rate, at any period of the charge, are the gassing of the cells and the temperature of the electrolyte.

Usual Rates

Stamped on the name plate of the battery are two charging rates, the lower of which is the "finishing rate." The higher figure is only given as being, under usual conditions, a satisfactory rate at which the greater part of the charge may be given.

Gassing

Reducing the Rate

Finishing Rate

Whenever the cells begin to give off gas, lower the rate; when the current has been reduced in one or more steps to the "finishing rate" given on the name plate, continue at this rate until all the cells in the battery are gassing uniformly. If at any time during the charge the temperature of the electrolyte reaches 110° F., the rate must be reduced or the charge temporarily stopped.

High Temperature

Quick Charging

A full or partial charge can, in case of necessity, be given the battery in a very short time by starting the charge at a high rate. Particular care must be taken to reduce the rate whenever gassing begins.

OVER-CHARGE

Overcharge Periodically

Once each week, and immediately after the battery has received its regular charge, give it an overcharge of not less than three hours at one-half the "finishing rate."

AMPERE HOUR METER

An ampere hour meter, when used, should be set or adjusted to give the battery the amount of charge

Page 2

Page 3

necessary to produce the uniform gassing at the "finishing rate," which indicates the completion of a regular charge. This amount is usually from 10 to 15 per cent. in excess of the discharge. The weekly overcharge should be given irrespective of the ampere hour meter.

HYDROMETER READINGS

Once a month and immediately after the regular overcharge check the condition of the battery by hydrometer readings. If the specific gravity of the electrolyte of any cell is higher than 1.300 or lower than 1.250, the cause should be promptly investigated and corrected.

Pilot Cell

Since, during a discharge, the drop in specific gravity of the electrolyte is directly proportional to the amount of the discharge, one of the cells of the battery may be regularly used as a "pilot cell" for taking hydrometer readings, which are of value to indicate the state of charge or discharge of the battery at any time.

Page 4

BATTERY IDLE

When a battery is to remain idle for a period of not to exceed four months, see that it is in good condition and give it an overcharge immediately before and after the idle period. If more than four months, send it to your battery man.

LEAKING JAR

If a jar develops a leak, have it replaced at once.

PERIODICAL INSPECTION

Uniformly decreasing specific gravity throughout the battery [when not due to insufficient charging] indicates that sediment is accumulating in the bottom of the jars. An inspection should be made by a competent battery man when the specific gravity of the fully charged battery is below 1.250.

"Exide" INSPECTION SERVICE

In territories covered by The Electric Storage Battery Company's Service Department, the Company will be glad to have an inspector, on one of his periodical trips, make an inspection free of charge.

If advice is desired, which cannot be obtained locally, write, giving full

Page 5

particulars and especially all markings on the name plate on the battery trays, to

THE ELECTRIC STORAGE BATTERY CO.

Allegheny Ave. and 19th St.

Philadelphia, Pa.

THE SERVICE ORGANIZATION OF

THE ELECTRIC STORAGE BATTERY CO.

SALES OFFICES

Philadelphia New York Boston Chicago St. Louis Cleveland Atlanta Denver Detroit San Francisco Seattle Los Angeles Portland, Ore. Toronto

CONSTRUCTION DEPT. BRANCHES

Philadelphia New York Boston Chicago Cleveland San Francisco

OPERATING DEPT. BRANCHES

Philadelphia New York Boston Chicago San Francisco

"Exide" DEPOTS and STORE ROOMS

New York Boston Chicago St. Louis Cleveland Atlanta Denver Kansas City San Francisco

"Exide" INSPECTION DEPARTMENT DISTRICT HEADQUARTERS

Boston Philadelphia Cleveland Chicago San Francisco

"Exide" INSPECTORS

Boston Rochester New York Philadelphia Atlanta Cincinnati Cleveland Detroit Chicago St. Louis Minneapolis Kansas City Denver San Francisco

863 "Exide" Distributors

Page 6

THE ELECTRIC STORAGE BATTERY CO.

MANUFACTURER OF

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago **PHILADELPHIA, PA.** Denver San Francisco Seattle

St. Louis Cleveland Atlanta Detroit 1888-1913 Los Angeles Portland, Ore. Toronto

Brand or Trade Name. (Number in parenthesis refers to Key, page 60).	Normal load rating, in pounds.	POWER TRANSMISSION SYSTEM																														
		CONTROLLER				TRANSMISSION, MOTOR TO JACKSHAFT				DIFFEREN'L				DRIVE TO ROAD WHEELS												MISC'S						
		Type (Drum or Knife-blade)	Number of forward speeds	Number of reverse speeds	Maker of controller (The number refers to a key on page 60)	Kind (Bevel, Chain, Spur, Worm)	Chain, Inclosed or Open	Pitch of chain	Maker of chain (The number refers to a key on page 60)	Kind of differential (Bevel or Spur)	Bearings of pinions (Ball, Plain, Roller)	Is a differential lock provided? (Yes or No)	Maker of differential (The number refers to a key on page 60)	Type (Bevel, Chain, External spur, Friction, Herringbone gear, Internal spur, Worm)	Reduction ratio	Chain Inclosed or Open	Pitch of chain	Maker of chain (The number refers to a key on page 60)	Shaft Inclosed or Open	Is worm Above or Below worm wheel?	Maker of worm drive (The number refers to a key on page 60)	Jackshaft demountable? (Yes or No)	Maker of jackshaft (The number refers to a key on page 60)	Is torque rod fitted? (Yes or No)	Are radius rods fitted? (Yes or No)	Inclination of radius rods to horizontal, in degrees	Length of radius rods between centers	Are distance rods fitted? (Yes or No)
Baker (4)	500	D	6	3	..	X	..	..	..	B	B	N	O	C		I	..	..	I	..	..	..	..	Y	N	..	..	Y
C. T. (5)	500	D	3	2	O	X	..	..	..	B	O	N	O	W	9.7:1	..	..	..	I	A	..	X	..	N	N	..	..	N
G. V. (8)	750	..	4	2	..	C	O	..	17	..	..	..	..	C	..	O	..	..	..	..	..	..	..	N	N	..	..	N
Argo (2)	1000	D	4	2	6	B	..	..	..	B	B	N	..	B	12	..	..	..	..	..	..	..	..	N	N	..	..	N
Baker (4)	1000	D	5	3	12	C	I	..	..	S	B	N	O	C		O	..	..	..	..	..	Y	O	Y	Y	..	..	Y
C. T. (5)	1000	D	3	2	O	X	..	..	..	B	P	N	O	W	9.7:1	..	..	..	I	A	..	..	..	N	N	..	..	N
Detroit (1)	1000	D	5	5	O	C	I	¾	19	B	P	N	O	C	10:1	O	1	7	..	..	..	..	..	N	Y	15	21	Y
G. M. C. (7)	1000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
G. V. (8)	1000	..	4	2	..	C	O	..	17	..	..	..	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
Lansden (9)	1000	D	4	2	12	B	..	..	..	B	P	N	4	C	8	O	1¼	27	..	..	..	Y	O	N	Y	10	..	Y
Ward (10)	1000	D	4	2	12	C	..	¾	17	S	P	N	5	C		O	1	27	..	..	..	..	..	N	N	..	..	N
Waverley (11)	1000	K	4	4	O	C	I	..	..	B	R	N	O	H	23:7	..	..	..	I	..	..	Y	O	N	N	..	..	N
Argo (2)	2000	D	4	3	6	B	..	..	..	B	B	N	1	B	12	..	..	..	..	..	..	..	1	N	N	..	..	N
Atlantic (3)	2000	..	4	2	..	C	I	..	17	..	B	N	..	C		O	..	..	..	..	..	..	..	N	N	..	..	N
Baker (4)	2000	D	5	3	12	C	I	..	..	S	B	N	O	C		O	..	..	..	..	..	Y	..	Y	Y	..	..	Y
C. T. (5)	2000	D	4	2	O	X	..	..	..	..	..	..	..	I	11.5:1	..	..	..	I	..	..	..	..	N	N	..	..	N
Detroit (1)	2000	D	5	5	O	C	I	¾	19	D	P	N	O	C	11.6:1	O	1	7	..	..	..	..	..	N	Y	14	21	Y
G. M. C. (7)	2000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
G. V. (8)	2000	..	4	2	..	C	O	..	17	..	..	..	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
Lansden (9)	2000	D	4	2	12	B	..	..	..	B	P	N	4	C	10:1	O	1¼	27	..	..	..	Y	O	N	Y	12	..	Y
Ward (10)	2000	D	4	2	12	C	..	¾	17	S	P	N	5	C		O	1¼	27	..	..	..	..	..	N	N	..	..	N
Waverley (11)	2000	K	4	4	O	C	I	..	..	B	B	N	O	H	25:7	..	..	..	I	..	..	Y	21	N	Y	..	..	N
G. M. C. (7)	3000	D	5	2	12	B	..	..	..	B	..	N	..	..	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
Atlantic (3)	4000	..	4	2	..	C	I	..	..	..	B	N	..	C		O	..	..	..	..	..	..	..	N	N	..	..	N
Baker (4)	4000	D	5	3	12	C	I	..	..	S	B	N	O	C		O	..	..	..	..	..	Y	O	Y	Y	..	..	Y
C. T. (5)	4000	D	4	2	O	X	..	..	..	..	..	..	..	I	12.1:1	..	..	..	I	..	..	..	..	N	N	..	..	N
G. M. C. (7)	4000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
G. V. (8)	4000	..	4	2	..	C	O	..	17	..	..	..	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
Lansden (9)	4000	D	4	2	12	B	..	..	..	B	P	N	4	C	5:1	O	1¼	27	..	..	..	..	O	N	Y	12	..	Y
Ward (10)	4000	D	4	2	12	C	..	¾	17	S	P	N	5	..	....	O	1¼	27	..	..	..	..	..	N	N	..	..	N
Waverley (11)	4000	D	4	4	12	B	..	..	..	B	R	N	22	C	47:15	O	1¼	7	..	..	..	Y	22	Y	Y	16	31½	N
Atlantic (3)	6000	..	4	2	..	C	I	..	..	..	B	N	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
G. M. C. (7)	6000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
Baker (4)	7000	D	5	3	12	C	I	..	..	S	B	N	O	C	....	I	..	..	..	..	..	Y	O	Y	Y	..	..	Y
C. T. (5)	7000	D	4	2	O	X	..	..	..	..	..	..	..	I	17.3:1	..	..	..	..	..	..	..	..	N	N	..	..	N
Couple Gear (6)	7000	D	5	5	O	X	..	..	..	..	P	N	..	B	25:1	..	..	..	..	..	..	..	..	Y	N	10	..	N
Detroit (1)	7000	D	5	5	O	C	I	¾	19	B	P	N	O	C	13.1:1	O	1¼	7	..	..	..	..	..	N	Y	15	36	Y
G. V. (8)	7000	..	4	2	..	C	O	..	17	..	..	..	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
Lansden (9)	7000	D	4	2	12	B	..	..	..	B	P	N	4	C	13	O	1¼	27	..	..	..	Y	O	N	Y	12	..	Y
Waverley (11)	7000	D	5	5	12	B	..	..	..	B	R	N	22	C	47:15	O	1¼	7	..	..	..	Y	22	Y	Y	12	34	N
G. M. C. (7)	8000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
Ward (10)	8000	D	4	2	12	C	..	¾	17	S	P	N	5	..	....	O	1¼	27	..	..	..	..	..	N	N	..	..	N
Atlantic (3)	10000	..	4	2	..	C	I	..	..	..	B	N	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
C. T. (5)	10000	D	4	2	O	X	..	..	..	..	..	..	..	EI	20.1:1	..	..	..	..	..	..	..	..	N	N	..	..	N
Couple Gear (6)	10000	D	5	5	O	X	..	..	..	X	..	..	..	B	25:1	..	..	..	..	..	..	..	..	Y	Y	10	..	N
G. M. C. (7)	10000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y
G. V. (8)	10000	..	4	2	..	C	O	..	17	..	..	..	..	C	....	O	..	..	..	..	..	..	..	N	N	..	..	N
Lansden (9)	10000	D	4	2	12	B	..	..	..	B	P	N	4	C	14½	O	1¼	27	..	..	..	Y	O	N	Y	12	..	Y
Waverley (11)	10000	D	5	5	12	B	..	..	..	B	R	N	22	C	45:15	O	1¼	7	..	..	..	Y	22	Y	Y	12	35	Y
G. M. C. (7)	12000	D	5	2	12	B	..	..	..	B	..	N	..	C	....	I	..	..	..	..	..	Y	..	N	Y	..	..	Y

NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns the letter "O" means "own."

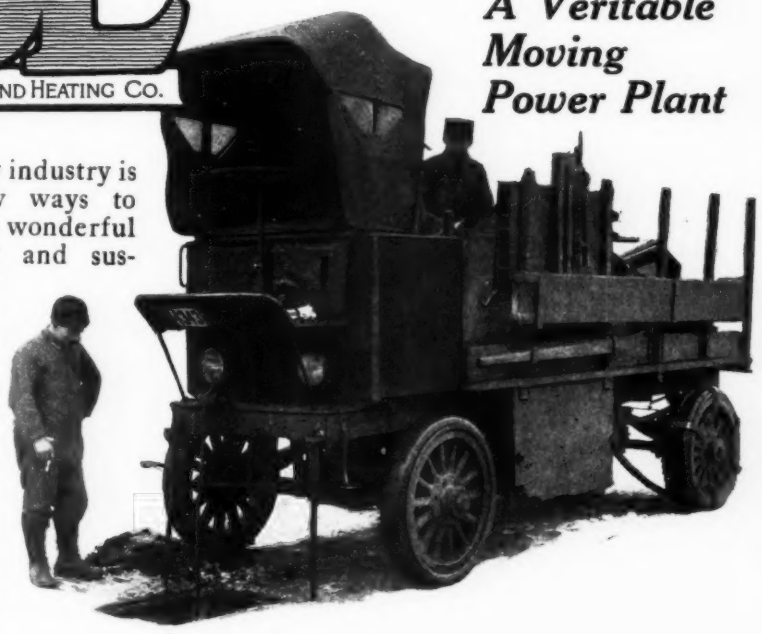
USL USL USL USL

USL TRADE MARK

THE UNITED STATES LIGHT AND HEATING CO.

Storage Battery

A Veritable Moving Power Plant



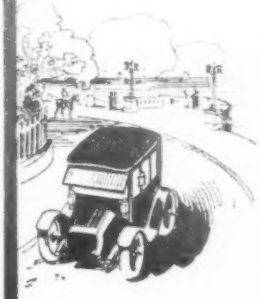
ALMOST every day industry is discovering new ways to make use of the wonderful voltage dependability and sustained energy capacity of the **U-S-L** Storage Battery in connection with truck transportation. For example, concerns have converted it into a portable power station which, when not engaged in propelling heavy vehicles, is used as a plant for hoisting, or for cable service work as shown in the illustration.

Such work frequently involves heavy and rapid discharge, with suddenly applied overloads and other irregularities which only emphasize the superiority of the **U-S-L** Battery to withstand the excessive drains of strenuous vehicle service.

In the **U-S-L** Battery the ideal mean between high capacity and light weight is reached. It is the most economical of batteries, because it gives greater power output per unit of current intake than any other battery, regardless of name or kind.

Its responsiveness, liveliness and long life are putting it into the best trucks and pleasure cars in America. Specify and *insist* upon **U-S-L.**

U-S-L Service



stands back of every installation, bringing the services of trained experts, who co-operate with users to secure maximum efficiency. These men operate from stations in eight principal cities, where spare parts are always on hand. Write us or use the coupon for information.

The U. S. Light & Heating Company

General Offices: **30 Church St., New York** *Factory:* **Niagara Falls, N.Y.**

Branch Offices and Service Stations:
Chicago, New York, Boston, Cleveland, Buffalo, San Francisco, Detroit, St. Louis

Manufacturers also of the **U-S-L** Electric Starter and Lighter for Gasoline Automobiles

The United States Light & Heating Company
30 Church St., New York, N. Y.

Gentlemen: Please send me the U-S-L Bulletins checked below:

[ ] 1. Power for Electric Vehicles —Pleasure and Commercial.
[ ] 2. Electric Light for Railroad Cars.
[ ] 3. U-S-L Storage Batteries for Stationary Service.
[ ] 4. U-S-L Storage Batteries for Independent Electric Lighting.
[ ] 5. U-S-L Electric Starter and Lighter for Automobiles.
[ ] 6. U-S-L Sparker and Automobile Lighter and Sparker.

(NOTE—With the bulletins will go forward the U-S-L Book illustrating and describing the U-S-L facilities, service and products.)

Name .....
Street .....
City .....State .....

USL USL USL

Brand or Trade Name (Number in parenthesis refers to Key, page 60).	Normal load rating, in pounds.	FRAME — CONSTRUCTION: Section of side rails (Channel, I, Rectangular, Structural, Tubular)	Material (Armored wood, Iron, Pressed steel, Rolled steel, Wood)	Is frame inswept at front end? (Yes or No)	Is frame upswept for rear axle? (Yes or No)	Is frame trussed? (Yes or No)	FRAME — DIMENSIONS: Length of frame over all	Length of frame back of seat	Width of frame over front axle	Width of frame over rear axle	Height of frame on stripped chassis	Length of overhang beyond rear axle	RUNNING GEAR — SPRINGS — FRONT: Form (Full, 3/4, 1/2, or Scroll elliptic; or Transverse)	Length	Width	Camber	Number of leaves	REAR: Form, (Full, 3/4, 1/2, or Scroll elliptic; or Platform)	Length	Width	Camber	Number of leaves	AUX'L'Y: Form (Coil or Leaf)	Location (Front, Rear, or 4 wheels)
Baker (4)	500	C	P	N	N	N	100	36	30	30	28	17	½	36	1¼	..	..	F	38	1½	..	..	X	..
C. T. (5)	500	C	R	Y	N	Y	109	64	35½	44	32	24	½	36	1¼	..	9	½	42	2	..	10	C	R
G. V. (8)	750	..	P	N	N	N	..	58	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Argo (2)	1000	C	R	Y	N	N	129½	95½	35	45	..	24	½	40	2	10	..	½	48	2	10½	..	X	..
Baker (4)	1000	C	P	N	N	Y	132	80	36	36	32	22	½	40	2	..	..	½	40	2	..	..	X	..
C. T. (5)	1000	C	R	Y	N	Y	115½	70½	35½	44	34	24	½	40	1¼	..	7	½	42	2	..	14	C	R
Detroit (1)	1000	C	I	N	N	N	120	73	32	32	29	20	½	40	1¼	6½	7	½	40	1¼	5½	7	X	..
G. M. C. (7)	1000	C	R	N	N	N	150	88	49½	49½	28	..	½	..	..	..	..	½	..	..	..	..	C	R
G. V. (8)	1000	..	P	N	N	N	..	58	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Lansden (9)	1000	C	P	N	N	N	130	..	36	36	34	26	½	35	2	..	..	½	35	2	..	..	X	..
Ward (10)	1000	C	R	N	N	N	..	..	37½	37½	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Waverley (11)	1000	C	R	N	N	Y	111	72	29	29	33	17½	F	38	1¼	..	7	F	40	1¼	..	7	L	4
Argo (2)	2000	S	I	Y	N	Y	139½	105	35	45	30	24	½	40	2	10	..	½	48	2	10½	..	X	..
Atlantic (3)	2000	C	..	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Baker (4)	2000	C	P	N	N	Y	151	107	36	36	36	24	½	40	2½	..	..	½	44	2½	..	..	X	..
C. T. (5)	2000	C	R	Y	N	Y	144	99	41	51	34	24	½	46	2	..	14	½	48	2½	..	10	C	R
Detroit (1)	2000	C	I	N	N	N	124	84	40	40	30	20	½	40	2	6	7	½	40	2	5	7	X	..
G. M. C. (7)	2000	C	R	N	N	N	162	100	50	50	28	..	½	..	..	..	..	½	..	..	..	..	C	R
G. V. (8)	2000	..	P	N	N	N	..	96	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Lansden (9)	2000	C	P	N	N	N	160	..	36	36	35	36	½	35	2	..	..	½	38½	2	..	..	X	..
Ward (10)	2000	C	R	N	N	N	..	..	38½	38½	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Waverley (11)	2000	C	R	N	N	Y	171	120	38	38	39½	43	½	40	2½	12	17	½	42	2½	12	..	X	..
G. M. C. (7)	3000	C	R	N	N	N	174	112	49½	49½	28	..	½	..	..	..	..	½	..	..	..	..	C	R
Atlantic (3)	4000	C	..	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Baker (4)	4000	C	P	N	N	Y	190	144	42	42	36½	25	½	44	3	..	..	½	44	3	..	..	X	..
C. T. (5)	4000	C	R	N	N	Y	179	134	42	42	36	36	½	48	2½	..	11	½	48	3	..	13	X	..
G. M. C. (7)	4000	C	R	N	N	N	190	124	56½	56½	32	..	½	..	..	..	..	½	..	..	..	..	C	R
G. V. (8)	4000	..	P	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Lansden (9)	4000	C	P	N	N	N	176	..	44	44	35	36	½	40	2½	..	..	½	42	2½	..	..	X	..
Ward (10)	4000	C	R	N	N	N	..	..	38	38	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Waverley (11)	4000	C	R	N	N	Y	180	132	40	40	39	40	½	42	2½	9	12	½	44	2½	9½	12	X	..
Atlantic (3)	6000	C	..	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
G. M. C. (7)	6000	C	R	N	N	N	202	136	56	56	32	..	½	..	..	..	..	½	..	..	..	..	C	R
Baker (4)	7000	C	P	N	N	Y	226	180	42	42	40	26	½	44	3½	..	..	½	44	3½	..	..	X	..
C. T. (5)	7000	C	R	N	N	Y	176	165	33½	33½	38	30	½	48	3	..	9	½	48	3	..	9	C	4
Couple Gear (6)	7000	C	R	N	N	Y	14	13	42	42	42	40	½	44	3	..	11	½	44	3	..	11	C	4
Detroit (1)	7000	C	I	Y	N	Y	198	155	39	44½	36	30	½	48	3	7	8	½	48	3	6	9	L	R
G. V. (8)	7000	..	P	N	N	N	183	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Lansden (9)	7000	C	P	N	N	N	190	..	44	44	36	36	½	42	3	..	..	½	44	3	..	..	X	..
Waverley (11)	7000	C	R	N	N	Y	192	144	42	42	39	42½	½	42	3½	8	11	½	46	3½	8½	13	X	..
G. M. C. (7)	8000	C	R	N	N	N	214	148	55	55	32	..	½	..	..	..	..	½	..	..	..	..	C	R
Ward (10)	8000	C	R	N	N	N	....	38	38	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Atlantic (3)	10000	C	..	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
C. T. (5)	10000	C	R	N	N	Y	214½	204	33½	33½	38	36	½	48	3	..	12	½	48	3	..	12	C	4
Couple Gear (6)	10000	I	R	N	N	Y	180	168	42	42	42	40	½	44	3	..	11	½	44	3	..	11	C	4
G. M. C. (7)	10000	C	R	N	N	N	226	160	56	56	34	..	½	..	..	..	..	½	..	..	..	..	C	R
G. V. (8)	10000	..	P	N	N	N	..	..	..	..	..	..	½	..	..	..	..	½	..	..	..	..	X	..
Lansden (9)	10000	C	P	N	N	N	205	..	44	44	36	38	½	44	3½	..	..	½	48	3½	..	..	X	..
Waverley (11)	10000	C	R	N	N	Y	210	156	42	42	40½	45½	½	42	3½	8	12	½	48	3½	8½	16	X	..
G. M. C. (7)	12000	C	R	N	N	N	238	172	56	56	34	..	½	..	..	..	..	½	..	..	..	..	C	R

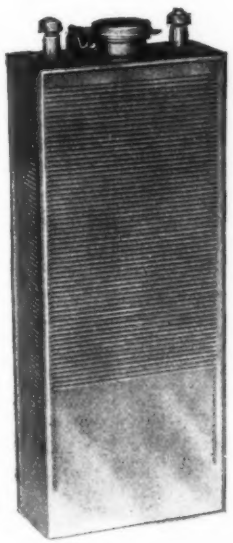
NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns the letter "O" means "own."

Invalids vs. Physical Giants as Warriors

Suppose Uncle Sam should dispense with the Physical Examination when recruiting men for the Army and Navy!

Wouldn't we be able to put up a fine resistance in the event of war!

Our fighting men must be *physically sound,* capable of withstanding hardship and actual abuse, whenever necessity demands.



A Storage Battery is AT WAR all the time.

Some Storage Batteries are not only easily destroyed by negligent or ignorant attendants, but will, unless closely watched, *destroy themselves.*

The Edison Storage Battery is a rugged, physically perfect specimen of Batteryhood—a well-balanced affair, having all thought of self-destruction left out of its composition.

People are finding this out very rapidly. That's why we are increasing our manufacturing facilities six-fold to take care of the demand.

Battling with hard work, vibration, concussion, neglect and ignorance is no occupation for an *invalid battery.*

Adopt the Physical Examination Method of selecting Storage Batteries and we know where the order will land.

Edison Storage Battery Co.

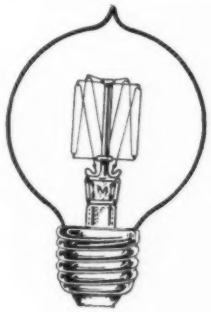
105 Lakeside Avenue **Orange, N. J.**

RUNNING GEAR—Cont'd

Brand or Trade Name (Number in parentheses refers to Key, page 60).	Normal load rating, in pounds.	AXLES														BRAKES									
		FRONT						REAR						MISC'S		SERVICE					EMERGENCY				
		Shape (Arched or Straight)	Cross section (Circular, I, Polygonal, Rectangular, Square, Tubular)	Dimensions of cross section (greatest diameter only)	Material of axle (see FOOTNOTE)	Pivot bearings (Ball, Plain or Roller)	Road clearance under lowest point of axle	Shape (Arched or Straight)	Cross section (Circular, I, Polygonal, Rectangular, Square or Tubular)	Dimensions of cross section (greatest diameter only)	Material of axle (see FOOTNOTE)	Kind of bearings (Ball, Plain or Roller)	Road clearance under lowest point of axle	Are tie rods fitted? (Yes or No)	Maker of axles (The number refers to a key on page 60)	Type (Contracting or Expanding)	Location (Differential, Front wheels, Jackshaft, Motor, Rear wheels, Speed-changing mechanism, 4 wheels)	Diameter of drum	Width of drum	Braking surface in square inches	Type (Contracting or Expanding)	Location (Differential, Front wheels, Jackshaft, Motor, Rear wheels, Speed-changing mechanism, 4 wheels)	Diameter of drum	Width of drum	Braking surface in square inches
Baker (4)	500	A	C			B	14	S	C	..	..	B	9	Y	1	E	R	12½	1⅛	..	E	R	12½	1⅛	..
C. T. (5)	500	S	T	2½	1	P	16	S	T	..	1	R	14	N	O	E	R	12½	2	102	X	..	..	..	..
G. V. (8)	750	S	C	2½	1	B	..	S	..	1½	1	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Argo (2)	1000	S	T	2	1	B	11	S	T	2½	C	B	11	Y	1	E	R	12	1½	110	E	..	12	1½	110
Baker (4)	1000	A	I	..	..	P	15	A	R	..	..	R	15	Y	22	E	R	10½	2	..	E	J	10½	1½	..
C. T. (5)	1000	S	T	2½	1	P	16	S	T	..	1	R	14	N	O	E	R	12½	2	102	X	..	..	..	..
Detroit (1)	1000	A	I	2½	1	P	12	A	P	2	1	R	12	Y	O	E	R	12	2	137	E	D	8	1½	68
G. M. C. (7)	1000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
G. V. (8)	1000	S	S	1½	1	B	..	S	C	1½	1	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Lansden (9)	1000	S	I	2	1	P	14	S	S	1½	3	R	14	Y	14	C	M	7	2	42	E	R	11	2	132
Ward (10)	1000	S	R	..	..	P	..	S	R	..	..	..	..	N	O	C	R	12	2½	..	X	..	..	..	..
Waverley (11)	1000	S	I	2½	1	R	12½	S	T	2½	3	R	15½	N	O	E	R	12	2	75½	C	M	8	1½	37½
Argo (2)	2000	S	T	2½	1	B	13	S	T	2½	1	B	11	Y	1	E	R	14	5	130	E	R	14	5	137
Atlantic (3)	2000	S	I	..	..	..	..	S	S	..	..	R	..	N	22	E	R	..	..	..	C	D	..	..	..
Baker (4)	2000	A	I	..	..	R	16	A	R	..	..	R	16	Y	22	E	R	12½	2½	..	E	J	10½	1½	..
C. T. (5)	2000	S	T	3	1	P	15	..	..	..	..	R	15	N	O	E	R	14½	2	120	X	..	..	..	..
Detroit (1)	2000	A	I	2½	3	P	11	A	P	2½	3	R	11	Y	O	E	R	12	2½	164	E	D	8	1½	87
G. M. C. (7)	2000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
G. V. (8)	2000	S	S	1½	1	B	..	S	C	2	1	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Lansden (9)	2000	S	I	2½	1	R	13	S	S	2	3	R	13	Y	14	C	M	8	2½	60	E	R	12	2½	90
Ward (10)	2000	S	R	..	..	P	..	S	R	..	..	..	..	N	O	C	R	14	2½	..	X	..	..	..	..
Waverley (11)	2000	S	I	2½	..	R	15½	S	T	3½	3	R	9½	Y	O	E	R	14	3½	137½	C	M	8	1½	38½
G. M. C. (7)	3000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
Atlantic (3)	4000	S	I	..	..	..	..	S	S	..	..	R	..	N	..	E	R	..	..	..	C	D	..	..	..
Baker (4)	4000	A	I	..	..	B	16	A	R	..	..	R	16	Y	..	E	R	15	3	..	E	J	10½	1½	..
C. T. (5)	4000	S	T	4	1	P	15	..	..	..	..	R	15	N	O	E	R	17½	2	149	X	..	..	..	..
G. M. C. (7)	4000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
G. V. (8)	4000	S	C	2⅞	1	B	..	S	C	2⅞	1	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Lansden (9)	4000	S	I	3½	1	R	15	S	S	2½	3	R	15	Y	14	C	M	8	2½	60	E	R	14	3	126
Ward (10)	4000	S	R	..	..	P	..	S	R	..	..	..	..	N	O	C	R	16	3	..	X	..	..	..	..
Waverley (11)	4000	S	I	3½	D	R	16	S	R	3½	..	R	16½	Y	22	E	R	18	3½	198	C	J	12½	2	78
Atlantic (3)	6000	S	I	..	..	..	..	S	S	..	..	..	..	N	..	E	R	..	..	..	C	D	..	..	..
G. M. C. (7)	6000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
Baker (4)	7000	A	I	..	..	R	16	A	R	..	..	R	16	Y	22	E	W	18	3	..	E	R	18	3	..
C. T. (5)	7000	..	..	..	1	P	12	..	..	..	1	R	12	N	O	C	R	17½	2½	180	X	..	..	..	..
Couple Gear (6)	7000	S	S	3	1	P	11	S	S	3	1	P	11	Y	O	C	R	17	2	400	X	..	..	..	..
Detroit (1)	7000	A	I	3½	3	B	11	A	S	4	3	R	11	Y	O	E	R	16	3	270	E	D	12	2	117
G. V. (8)	7000	S	C	2½	1	B	..	S	C	2½	1	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Lansden (9)	7000	S	I	4	1	R	14	S	R	3	3	R	14	Y	14	C	M	9	3	81	E	R	15	3	135
Waverley (11)	7000	S	I	4	..	R	16½	S	R	3½	..	R	16½	Y	22	E	R	18	3½	198	E	J	14	2½	110
G. M. C. (7)	8000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
Ward (10)	8000	S	R	..	..	P	..	S	R	..	..	..	..	N	O	C	R	18	3½	..	X	..	..	..	..
Atlantic (3)	10000	S	I	..	..	..	..	S	S	..	..	R	..	N	..	E	R	..	..	..	C	D	..	..	..
C. T. (5)	10000	..	..	..	1	P	12	..	..	..	1	R	12	N	O	C	R	17½	2½	180	X	..	..	..	..
Couple Gear (6)	10000	S	S	3½	1	P	11	S	S	3½	1	P	11	Y	O	C	R	17	2	400	X	..	..	..	..
G. M. C. (7)	10000	S	S	..	..	P	..	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..
G. V. (8)	10000	S	C	2½	1	R	..	S	C	2½	4	R	..	Y	..	E	R	..	..	..	E	R	..	..	..
Lansden (9)	10000	S	I	4	1	R	14	S	R	3½	3	R	14	Y	14	C	M	9	3	81	E	R	16½	3½	150
Waverley (11)	10000	S	I	4	..	R	16½	S	R	4½	..	R	15½	Y	22	E	R	20	4	251	C	J	14	2½	110
G. M. C. (7)	12000	S	S	..	..	P	.	A	C	..	..	B	..	N	..	E	R	..	..	..	E	D	..	..	..

FOOTNOTE.—Kinds of steel: (1) carbon; (2) chrome; (3) chrome-nickel; (4) chrome-vanadium; (5) manganese; (6) manganese-nickel; (7) molybdenum; (8) nickel, (9) silicon; (10) silico-manganese; (11) sodium; (12) titanium; (13) vanadium. NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns, the letter "O" means "own."

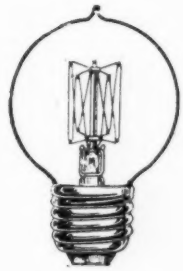
Electric Vehicle Equipment



(½ Size) 15 and 25 watts, 21-90 volts

Three-gang Push Button Switch

Commercial Vehicle Charging Receptacle and Plug



(½ Size) 15 and 25 watts, 21-65 volts

Edison Mazda Lamps, Commercial vehicle type, are of the same high efficiency as the well-known Edison Mazda Lamps used for all kinds of lighting the world over. These lamps have strong, sturdy filaments, made from drawn wire tungsten that will withstand the jarring and jolting of the roughest roads.

Flush Push Button Switches are our well-known, standard push button switch in miniature. The switch is compact and takes up very little space. The buttons are metal and will not break off; the terminal plate at back is held by long screws which prevent loosening. Made in any combination of gangs.

Charging Plugs and Receptacles are substantial and strong; they withstand any reasonable amount of rough usage. The self-centering plug forms a rigid electrical connection between contacts; the generous areas assure transmission of charging current at the maximum of efficiency. Well insulated against accidental contact. Receptacle has a self-closing cover, protecting removable interior from moisture and dirt; interior walls enameled to prevent rust. Any of these devices may be obtained from local dealers or our nearest sales office.

General Electric Company

Largest Electrical Manufacturer in the World

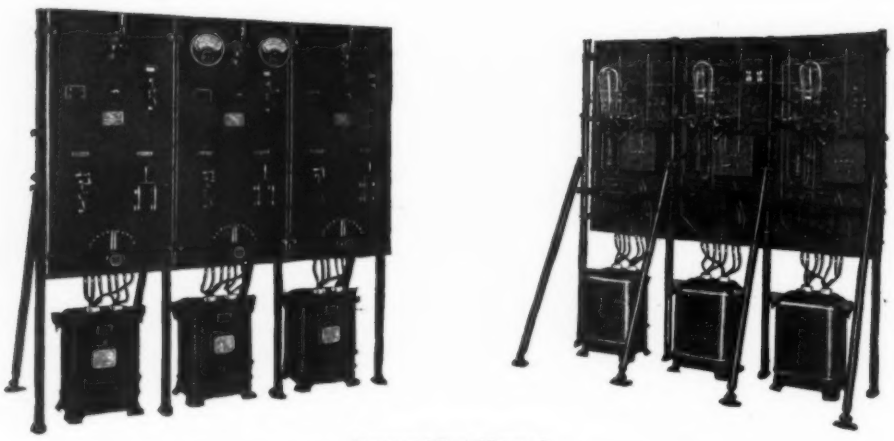
General Office: Schenectady, N. Y.

Sales Offices in all large Cities

3871

The Guarantee of Excellence — on Goods Electrical.

Battery Charging Equipment



Front and Back Views of
Three Panel Commercial Vehicle Type Rectifier. This set will charge three vehicles at once.

Convenience in Battery Charging With Mercury Arc Rectifiers

The idea that charging storage batteries is a mysterious and difficult operation has been handed down from the days of the earliest electrics when charging stations were few and far between and the charging outfit for the private garage was unknown.

These conditions have been changed by the invention of the rectifier, which rectifies or changes the alternating current furnished by most lighting and power companies, to direct current suitable for charging storage batteries.

With one of these rectifiers in the garage, all that is necessary to charge the battery is to insert a plug in a receptacle on the vehicle and start the rectifier.

The rectifier takes up very little space in the garage and can be installed anywhere where there are electric light wires.

In nearly every case the electric power company will make very low rates for energy for battery charging.

Write our nearest office for further information and prices.

General Electric Company

Largest Electrical Manufacturer in the World
General Office: Schenectady, N. Y.

ADDRESS NEAREST OFFICE

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boise, Idaho.
Boston, Mass.
Buffalo, N. Y.
Butte, Mont.
Charleston, W. Va.
Charlotte, N. C.
Chattanooga, Tenn.
Chicago, Ill.
Cincinnati, O.
Cleveland, O.
Columbus, O.
Davenport, Ia.
Dayton, O.
Denver, Colo.
Detroit, Mich.
(Office of Agent.)
Erie, Pa.
Indianapolis, Ind.
Kansas City, Mo.
Keokuk, Ia.
Knoxville, Tenn.
Los Angeles, Cal.
Louisville, Ky.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Nashville, Tenn.
New Haven, Conn.
New Orleans, La.
New York, N. Y.
Philadelphia, Pa.
Pittsburg, Pa.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Salt Lake City, Utah.
San Francisco, Cal
St. Louis, Mo.
Schenectady, N. Y.
Seattle, Wash.
Spokane, Wash.
Springfield, Mass.
Syracuse, N. Y.
Toledo, O.
Youngstown, O.

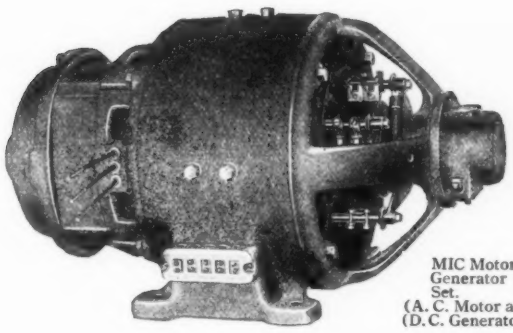
3390

For Texas and Oklahoma business refer to General Electric Company of Texas—Dallas, El Paso, Houston and Oklahoma City

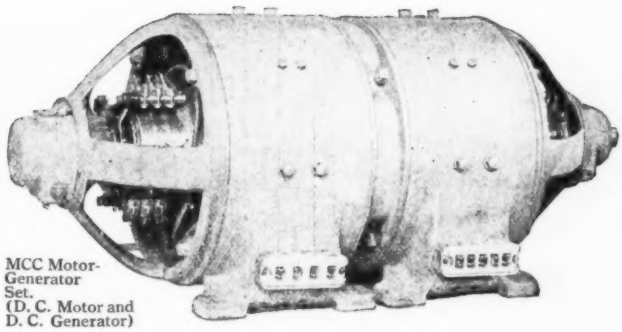
For Canadian business refer to Canadian General Electric Company, Lt'd, Toronto, Ont.

The Guarantee of Excellence — GE — on Goods Electrical.

Battery Charging Equipment



MIC Motor-Generator Set. (A. C. Motor and (D.C. Generator)



MCC Motor-Generator Set. (D. C. Motor and D. C. Generator)

Motor-Generator Sets, Charging Panels and Rheostats

The General Electric Company manufactures different types of battery charging equipment to meet the requirements of all users, from the largest public garage to the small private garage built for a single car.

For the large garage where there are a number of cars to be charged at the same time, one or more motor-generator sets will usually give the best results for the bulk of the work, but rectifiers can be used to good advantage as auxiliaries to take care of cars with exceptionally low or high voltage batteries, and also for long overcharges.

On direct current circuits of 220 volts or higher, motor generator sets will be most economical in nearly every case whatever the capacity of the garage may be. These sets are furnished in capacities from 1-8 kw. up.

For circuits of 110 to 125 volts, distributing panels with charging rheostats are simple and economical.

For cases where Central Station energy cannot be obtained, we have designed gasoline electric generating sets consisting of a gasoline engine direct connected to a D. C. Generator. The engine and generator are specially designed as parts of the set, making these outfits compact and reliable. These sets are economical and require very little attention.

General Electric Company

Largest Electrical Manufacturer in the World

General Office: Schenectady, N. Y.

ADDRESS NEAREST OFFICE

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boise, Idaho.
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Butte, Mont.
Charleston, W. Va.
Charlotte, N. C
Chattanooga, Tenn.
Chicago, Ill.
Cincinnati, Ohio.
Cleveland, Ohio.
Columbus, Ohio.
Davenport, Ia.
Dayton, Ohio.
Denver, Colo.
Detroit, Mich.
(Office of Agent)
Erie, Pa.
Indianapolis, Ind.
Kansas City, Mo.
Keokuk, Ia.
Knoxville, Tenn.
Los Angeles, Cal.
Louisville, Ky.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Nashville, Tenn.
New Haven, Conn.
New Orleans, La.
New York, N. Y.
Philadelphia, Pa.
Pittsburg, Pa.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.
Salt Lake City, Utah.
San Francisco, Cal.
Schenectady, N. Y.
St. Louis, Mo.
Seattle, Wash.
Spokane, Wash.
Springfield, Mass.
Syracuse, N. Y.
Toledo, Ohio.
Youngstown, Ohio.

For Texas and Oklahoma business refer to General Electric Co. of Texas,—Dallas, El Paso, Houston and Oklahoma City.

For Canadian business refer to Canadian General Electric Company, Lt'd, Toronto, Ont. 3496

The Guarantee of Excellence - on Goods Electrical.

Brand or Trade Name (Number in parenthesis refers to Key, page 60).	Normal load rating, in pounds.	RUNNING GEAR—Cont'd																			CONTROL				ADJUSTMENTS				
		WHEELS											STEERING MECHANISM			OTHER DETAILS					LOCATION OF CONTROL LEVERS				ARE TAKE-UPS AND ADJUSTMENTS PROVIDED FOR—?				
		FRONT			REAR			MISC'S																					
		Material (Steel or Wood)	Diameter	Kind of bearings (Ball, Plain, Roller)	Material (Steel or Wood)	Diameter	Kind of bearings (Ball, Plain, Roller)	Are wheels demountable? (Yes or No)	Are rims demountable? (Yes or No)	Number of road wheels	Number of driving wheels	Driving wheels (Front, Rear or 4)	System (Tiller or Wheel)	Type (Pinion and sector, Rack and pinion, Screw and nut, Worm and gear)	Maker of steering gear (The number refers to a key on page 60)	Wheelbase	Tread of front wheels	Tread of rear wheels	Width over rear hub caps	Diameter of turning circle in inches	Steering post location (Center, Left or Right side)	Controller handle (Front of driver, beside Seat or on Wheel)	Service brake operated by (Foot or Hand)	Emergency brake operated by (Foot or Hand)	Brakes? (Yes or No)	Driving chains? (Yes or No)	Driving gears? (Yes or No)	Steering gear? (Yes or No)	Front wheels? (Yes or No)
Baker (4)	500	W	32	R	W	32	R	Y	N	4	2	R	W	W	O	80	50	50	65	...	L	W	F	F	Y	Y	Y	Y	Y
C. T. (5)	500	W	30	R	W	30	R	Y	N	4	2	R	W	W	..	85	56½	56½	70	456	L	W	F	H	Y	..	..	..	Y
G. V. (8)	750	W	76	R	W	76	R	Y	Y	4	2	R	W	..	..	76	..	..	..	...	..	S	F	..	Y	Y	Y	Y	Y
Argo (2)	1000	W	34	R	W	34	R	N	N	4	2	R	W	S	20	86	54	54	..	336	L	W	F	F	Y	..	Y	Y	Y
Baker (4)	1000	W	34	R	W	34	R	Y	N	4	2	R	W	R	O	85	56	56	70	...	L	W	F	H	Y	Y	..	Y	Y
C. T. (5)	1000	W	30	R	W	30	R	Y	Y	4	2	R	W	W	..	90	56½	56½	70	480	L	W	F	H	Y	..	..	..	Y
Detroit (1)	1000	W	32	R	W	34	R	N	Y	4	2	R	W	W	11	80	56	56	65	400	L	W	F	F	Y	Y	Y	Y	Y
G. M. C. (7)	1000	W	32	R	W	32	R	N	Y	4	2	R	W	R	..	94	57½	57½	..	432	L	W	F	F	Y	Y	Y	Y	N
G. V. (8)	1000	W	..	R	W	..	R	Y	Y	4	2	R	W	..	..	76	..	..	..	...	..	S	F	..	Y	Y	Y	Y	Y
Lansden (9)	1000	W	30	R	W	30	R	N	N	4	2	R	W	W	2	96	56	56	66	192	L	W	F	F	Y	Y	Y	Y	Y
Ward (10)	1000	W	34	R	W	34	R	Y	N	4	2	R	W	P	O	84	54	54	..	...	L	S	F	..	Y	Y	..	N	Y
Waverley (11)	1000	W	34	R	W	34	R	Y	N	4	2	R	W	W	11	91	56	56	65	384	L	S	F	F	Y	Y	Y	Y	Y
Argo (2)	2000	W	34	R	W	34	R	N	N	4	2	R	W	S	20	96	54	54	..	420	L	W	F	F	Y	..	Y	Y	Y
Atlantic (3)	2000	W	34	R	W	36	R	N	Y	4	2	R	W	..	..	102	..	..	..	...	L	S	F	F	N	N	N	N	N
Baker (4)	2000	W	36	R	W	36	R	Y	N	4	2	R	W	R	O	102	56	56	70	...	L	W	F	H	Y	Y	..	Y	Y
C. T. (5)	2000	W	30	R	W	30	R	Y	N	4	2	R	W	W	..	100	56½	56½	74	504	L	W	F	H	Y	..	..	..	Y
Detroit (1)	2000	W	32	R	W	34	R	N	Y	4	2	R	W	W	11	84	58	58	71	400	L	W	F	F	Y	Y	Y	Y	Y
G. M. C. (7)	2000	W	32	B	W	32	B	N	Y	4	2	R	W	R	..	104	57½	57½	..	480	L	W	F	F	Y	Y	Y	Y	N
G. V. (8)	2000	W	..	R	W	..	R	Y	Y	4	2	R	W	..	..	102	..	..	..	...	C	S	F	..	Y	Y	Y	Y	Y
Lansden (9)	2000	W	30	R	W	30	R	N	N	4	2	R	W	W	2	106	56	56	68	204	L	W	F	F	Y	Y	Y	Y	Y
Ward (10)	2000	W	34	R	W	34	R	N	N	4	2	R	W	P	O	96	57	57	..	...	L	S	F	..	Y	Y	..	N	Y
Waverley (11)	2000	W	34	R	W	34	R	Y	Y	4	2	R	W	S	20	108	58	58	..	432	L	S	F	F	Y	Y	Y	Y	Y
G. M. C. (7)	3000	W	32	B	W	32	B	N	Y	4	2	R	W	R	..	112	57½	57½	..	516	L	W	F	F	Y	Y	Y	Y	N
Atlantic (3)	4000	W	34	R	W	36	R	N	Y	4	2	R	W	..	..	114	..	..	..	...	L	S	F	F	N	N	N	N	N
Baker (4)	4000	W	36	R	W	36	R	Y	N	4	2	R	W	R	O	120	64	64	79	...	L	W	F	H	Y	Y	..	Y	Y
C. T. (5)	4000	W	30	R	W	30	R	Y	N	4	2	R	W	W	..	116	66	66	76	576	L	W	F	H	Y	..	..	..	Y
G. M. C. (7)	4000	W	32	B	W	36	B	N	Y	4	2	R	W	R	..	120	65½	65½	..	492	L	W	F	F	Y	Y	Y	Y	N
G. V. (8)	4000	W	..	R	W	..	R	Y	Y	4	2	R	W	..	..	111½	..	..	..	...	C	S	F	..	Y	Y	Y	Y	Y
Lansden (9)	4000	W	30	R	W	30	R	N	N	4	2	R	W	W	2	120	66	66	78	216	L	W	F	F	Y	Y	Y	Y	Y
Ward (10)	4000	W	36	R	W	36	R	Y	N	4	2	R	W	P	O	114	60	60	..	...	L	S	F	..	Y	Y	..	N	Y
Waverley (11)	4000	W	36	R	W	36	R	Y	Y	4	2	R	W	S	20	114	65	65	81	528	L	S	F	F	Y	Y	Y	Y	Y
Atlantic (3)	6000	W	36	R	W	40	R	N	N	4	2	R	W	W	..	135	71	..	..	...	L	S	F	F	N	N	N	N	N
G. M. C. (7)	6000	W	32	B	W	36	B	N	Y	4	2	R	W	R	..	132	68½	68½	..	540	L	W	F	F	Y	Y	Y	Y	N
Baker (4)	7000	W	36	R	W	38	R	Y	N	4	2	R	W	R	O	134	64	68	84	...	L	W	F	H	Y	Y	..	Y	Y
C. T. (5)	7000	W	30	R	W	30	R	Y	N	4	4	4	W	W	..	115	66	66	80	576	L	W	F	H	Y	..	..	..	Y
Couple Gear (6)	7000	S	36	R	S	36	R	Y	Y	4	4	4	W	W	O	96	66	66	78	312	R	F	F	H	Y	..	Y	Y	Y
Detroit (1)	7000	W	36	R	W	36	R	N	Y	4	2	R	W	W	24	132	72	72	84	552	L	W	F	F	Y	Y	..	Y	Y
G. V. (8)	7000	W	..	R	W	..	R	Y	Y	4	2	R	W	..	..	128½	..	..	..	...	C	S	F	F	Y	Y	Y	Y	Y
Lansden (9)	7000	W	30	R	W	30	R	N	N	4	2	R	W	W	2	130	69	69	82	240	L	W	F	F	Y	Y	Y	Y	Y
Waverley (11)	7000	W	36	R	W	36	R	Y	Y	4	2	R	W	S	20	127	68	69	85	600	L	S	F	F	Y	Y	Y	Y	Y
G. M. C. (7)	8000	W	32	B	W	36	B	N	Y	4	2	R	W	R	..	138	68½	68½	..	564	L	W	F	F	Y	Y	Y	Y	N
Ward (10)	8000	W	36	R	W	36	R	Y	N	4	2	R	W	P	O	132	63	63	..	...	L	S	F	..	Y	Y	..	N	Y
Atlantic (3)	10000	W	36	R	W	40	R	N	N	4	2	R	W	..	..	144	75	..	..	...	..	..	..	..	N	N	N	N	N
C. T. (5)	10000	W	30	R	W	30	R	Y	N	4	4	4	W	W	..	132	66	66	80	...	L	W	F	H	Y	..	..	..	Y
Couple Gear (6)	10000	S	36	R	S	36	R	Y	Y	4	4	4	W	W	O	96	72	72	86	312	R	F	F	H	Y	..	Y	Y	Y
G. M. C. (7)	10000	W	36	B	W	36	B	N	Y	4	2	R	W	R	..	148	68½	68½	..	732	L	W	F	F	Y	Y	Y	Y	N
G. V. (8)	10000	W	..	R	W	..	R	Y	Y	4	2	R	W	..	..	139	..	..	..	...	C	S	F	..	Y	Y	Y	Y	Y
Lansden (9)	10000	W	30	R	W	30	R	N	N	4	2	R	W	W	2	142	72	72	85	290	L	W	F	F	Y	Y	Y	Y	Y
Waverley (11)	10000	W	36	R	W	36	R	Y	Y	4	2	R	W	S	20	136	69	72	91	624	L	S	F	F	Y	Y	Y	Y	Y
G. M. C. (7)	12000	W	36	B	W	36	B	N	Y	4	2	R	W	R	..	156	68½	68½	..	780	L	W	F	F	Y	Y	Y	Y	N

NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns the letter "O" means "own."

Commercial Vehicle Owners! You Can't Afford to Neglect This

READ EVERY WORD

"One year ago yesterday I purchased my Waverley Electric equipped with Gould Batteries. This vehicle has been in constant use, and I had resolved that after one year I would send you, unsolicited, the results of my experience. Mrs. Moore has run the car 4,867 miles to our utmost satisfaction.

"When purchasing, I believed, as is generally supposed, that towards the end of a year's usage the battery deteriorates rapidly. This is no doubt true of old style and many new batteries, but this improved Gould battery has been a great surprise to me. At first, a charge carried us ninety-two miles, and still had an unknown quantity left estimated to be from five to fifteen miles. Last week, I made a run of eighty-two miles on a single charge, and had considerable power left as indicated on the ampere hour meter. I consider this simply marvelous. I had a cell cut out to see if it needed a wash and found less than half an inch of sediment and was told to go on till spring. My carriage has run summer and winter, when the thermometer was much below zero, with never any trouble and my garage is not warmed.

"I do my own charging, the expense of which has been $82.90. Outside of that my carriage has cost me nothing for maintenance, except a few minor items, caused by carelessness."—W. C. Moore, Buffalo, (N. Y.) Evening News.

When the average electric pleasure car owner can bring maintenance costs down to the point indicated by this letter from Mr. Moore, of the Buffalo Evening News, it is only reasonable to state, as we have often proved, that owners of light or heavy electric commercial vehicles can profitably equip their cars with Gould Storage Batteries.

Extreme mileage per charge and at such a cost should appeal to every man wanting simple, safe, quick and dependable transportation for any kind of merchandise. At such battery costs, too, merchant or manufacturer cannot only handle deliveries to greatest advantage with an electrically operated car, but also is credited with a spirit of progressiveness that is of considerable advertising value among those who constantly see his up-to-date conveyances and methods.

Our fair treatment assures Gould Battery users the height of satisfaction. Tell us the number and capacity of cars you do or expect to operate so we can quote battery prices and advise you to your best interests.

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Brand or Trade Name (Number in parenthesis refers to Key, page 60).	Normal load rating, in pounds.	CHASSIS DETAILS: SPEED, PLATFORM DIMENSIONS, WEIGHT DISTRIBUTION, OVERLOAD									EQUIPMENT, INCLUDING TIRES: MISC. ACCESSORIES								TIRE PARTICULARS: FRONT TIRES					REAR TIRES				MISC'S		
		Normal road speed on level, in miles per hour	Length of truck over all, with standard body	Length of loading platform (standard body)	Width of loading platform (standard body)	Height of standard body platform, truck empty	Height of standard body platform, truck loaded	Percentage of weight on rear axle, truck empty	Percentage of weight on rear axle, truck loaded	Percentage overload capacity	Warning signal (Bell, Horn, or Special)	Maker of warning signal (The number refers to a key on page 60)	Is bumper provided? (Yes or No)	Is cab provided? (Yes or No)	Is jack provided? (Yes or No)	Shock absorbers? (Yes or No)	Maker of shock absorbers (The number refers to a key on page 60)	Tools? (Yes or No)	Kind (Cushion, Optional, Pneumatic, Solid)	Dual or Single?	Block, Continuous or Optional?	Width	Diameter	Kind (Cushion, Optional, Pneumatic, Solid)	Dual or Single?	Block, Continuous or Optional?	Width	Diameter	Maker of tires (The number refers to a key on page 60)	Cost of complete tire equipment, without extras	Mileage guaranteed by maker of tire equipment
Baker (4)	500	18	104	34	32	31	28½	..	..	..	B	..	N	N	Y	N	..	Y	P	S	C	3½	32	P	S	C	3½	32	..	.....	.....
C. T. (5)	500	15	127	66	44	34	32	60	60	..	B	..	N	Y	N	N	..	Y	S	S	O	2½	36	S	S	O	2½	36	..	.....	.....
G. V. (8)	750	..	118	58	40	53	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	2½	32	S	S	C	2½	32	..	.....	.....
Argo (2)	1000	13	...	90	42	35	22½	50	66	..	H	..	N	N	Y	N	..	Y	O	S	C	3	34	O	S	C	3	34	18	.....	8000
Baker (4)	1000	13	...	..	..	..	..	..	..	..	H	..	Y	Y	Y	..	..	Y	S	S	C	3	34	S	S	C	3	34	..	.....	.....
C. T. (5)	1000	15	134	66	44	36	34	60	60	..	B	..	N	Y	N	N	..	Y	S	S	O	2½	36	S	S	O	3	36	..	.....	.....
Detroit (1)	1000	14	129	72	42	31	30	50	60	..	B	25	Y	N	Y	N	..	Y	S	S	C	3	32	S	S	C	3	34	10	127.50	7500
G. M. C. (7)	1000	13	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	2½	32	S	S	C	3½	32	..	.....	.....
G. V. (8)	1000	..	131	72	41	60	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	2½	36	S	S	C	2½	36	..	.....	.....
Lansden (9)	1000	12	141	91	45	..	..	55	60	..	..	..	Y	N	N	N	..	Y	S	S	C	2½	36	S	S	C	2½	36	13	.....	8000
Ward (10)	1000	10	...	78	46	..	..	..	..	..	B	..	N	N	N	N	..	N	S	S	C	3	34	S	S	C	3	34	..	.....	.....
Waverley (11)	1000	11	131	72	43	36	33	54	61	..	B	O	N	Y	N	Y	..	Y	C	D	C	2½	34	C	D	C	2½	34	10	.....	.....
Argo (2)	2000	12	...	100	42	35	32½	50	66	..	H	..	N	N	Y	N	X	Y	O	S	C	3½	34	O	S	C	3½	34	18	.....	8000
Atlantic (3)	2000	15	...	..	..	..	..	..	..	..	B	..	N	N	N	N	..	Y	S	S	C	3	34	S	S	C	4	36	..	.....	.....
Baker (4)	2000	11	...	..	..	..	..	..	..	..	H	..	Y	Y	Y	N	..	Y	S	S	C	3½	36	S	S	C	3½	36	..	.....	.....
C. T. (5)	2000	12	146	96	50	36	34	60	60	..	B	..	Y	Y	N	N	..	Y	S	S	O	3½	36	S	S	O	4	36	..	.....	.....
Detroit (1)	2000	12	...	84	44	33	31	50	60	..	B	25	Y	N	Y	N	..	Y	S	S	C	3	32	S	S	C	3½	34	15	153.50	10000
G. M. C. (7)	2000	11	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	2½	32	S	S	C	4	32	..	.....	.....
G. V. (8)	2000	10	149	96	48	66	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	3	36	S	S	C	3½	36	..	.....	.....
Lansden (9)	2000	10	167	114	45	..	..	55	60	..	..	..	Y	N	N	N	..	Y	S	S	C	3	36	S	S	C	3	36	13	.....	8000
Ward (10)	2000	8	...	96	48	..	..	..	..	..	B	..	N	N	N	..	..	N	S	S	C	4	34	S	S	C	4	34	..	.....	.....
Waverley (11)	2000	12	171	118	42	44	42	61½	65½	..	B	O	Y	Y	N	N	..	Y	S	S	C	3½	34	S	S	C	3½	34	..	.....	.....
G. M. C. (7)	3000	10	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	3	32	S	S	C	5	32	..	.....	.....
Atlantic (3)	4000	12	...	..	..	..	..	..	75	..	B	..	N	N	N	N	..	Y	S	S	C	4	34	S	D	C	3½	36	..	.....	10000
Baker (4)	4000	9	...	..	..	..	..	..	..	..	H	..	Y	Y	Y	N	..	Y	S	S	C	4	36	S	D	C	3	36	..	.....	.....
C. T. (5)	4000	10	185	132	52	43	41	60	60	..	B	..	N	N	N	N	..	Y	S	S	O	5	36	S	D	O	3½	36	..	.....	.....
G. M. C. (7)	4000	9	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	3	32	S	S	C	3	36	..	.....	.....
G. V. (8)	4000	9	166	115	56	72	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	4	36	S	D	C	2½	36	..	.....	.....
Lansden (9)	4000	9	183	132	50	..	..	50	55	..	..	..	Y	N	N	N	..	Y	S	S	C	4	36	S	D	C	3	36	13	.....	8000
Ward (10)	4000	6 5	...	117	50	..	..	..	..	..	B	..	N	N	N	N	..	N	S	S	C	5	36	S	S	C	3	36	..	.....	.....
Waverley (11)	4000	9	185½	132	54	44	41	59	60	..	B	O	Y	N	N	N	..	Y	S	S	C	4	36	S	D	C	3	36	..	.....	.....
Atlantic (3)	6000	10	...	..	..	..	..	..	..	..	B	..	N	N	N	N	..	N	S	S	C	5	36	S	D	C	4	40	..	.....	.....
G. M. C. (7)	6000	8	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	3½	32	S	S	C	3½	36	..	.....	.....
Baker (4)	7000	8	...	..	..	..	..	..	..	..	H	..	Y	Y	Y	N	..	Y	S	S	O	6	36	S	D	O	4	38	..	.....	.....
C. T. (5)	7000	9	180	144	60	43	41	45	50	..	B	..	N	N	N	N	..	Y	S	D	O	3½	36	S	D	O	3½	36	..	.....	.....
Couple Gear (6)	7000	9	192	168	66	46	43	50	50	..	B	3	N	N	Y	N	..	Y	S	D	C	3½	36	S	D	C	3½	36	16	360.00	7000
Detroit (1)	7000	..	216	154	56	39	36½	50	65	..	B	25	Y	N	N	N	..	Y	S	S	C	6	36	S	D	C	4	36	15	352.34	10000
G. V. (8)	7000	8	183	139	60	72	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	6	36	S	D	C	3½	36	..	.....	.....
Lansden (9)	7000	8	198	144	54	..	..	50	55	..	..	..	Y	N	N	N	..	Y	S	S	C	5	36	S	D	C	3½	36	13	.....	8000
Waverley (11)	7000	8	198	144	60	44	41	60	62½	..	B	O	Y	N	N	N	..	Y	S	S	C	6	36	S	D	C	3½	36	..	.....	.....
G. M. C. (7)	8000	7½	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	4	32	S	S	C	4	36	..	.....	.....
Ward (10)	8000	5	...	144	52	..	..	..	..	..	B	..	N	N	N	N	..	N	S	S	C	6	36	S	S	C	4	36	..	.....	.....
Atlantic (3)	10000	8	...	..	..	..	..	..	..	..	B	..	N	N	N	N	..	N	S	S	C	6	36	S	D	C	5	40	..	.....	.....
C. T. (5)	10000	7	...	180	66	43	41	45	50	..	B	..	N	N	N	N	..	Y	S	D	O	4	36	S	D	O	4	36	..	.....	.....
Couple Gear (6)	10000	6	204	180	72	46	43	50	50	..	B	3	N	N	Y	N	..	Y	S	D	C	4	36	S	D	C	4	36	16	460.00	7000
G. M. C. (7)	10000	7	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	5	36	S	S	C	5	36	..	.....	.....
G. V. (8)	10000	7	209	163	72	72	..	50	50	..	B	..	N	Y	N	N	..	N	S	S	C	7	36	S	D	C	5	36	..	.....	.....
Lansden (9)	10000	7	208	162	57	..	..	50	55	..	..	..	Y	N	N	N	..	Y	S	S	C	6	36	S	D	C	4	36	13	.....	8000
Waverley (11)	10000	7	210	156	78	45½	42	60	60	..	B	O	Y	N	Y	N	..	Y	S	S	C	7	36	S	D	C	5	36	..	.....	.....
G. M. C. (7)	12000	6½	...	..	..	..	..	..	..	..	B	..	Y	N	N	N	..	Y	S	S	C	5	36	S	S	C	5	36	..	.....	.....

NOTE: The letter "X," wherever it appears, means "none." Under "Maker" columns the letter "O" means "own."

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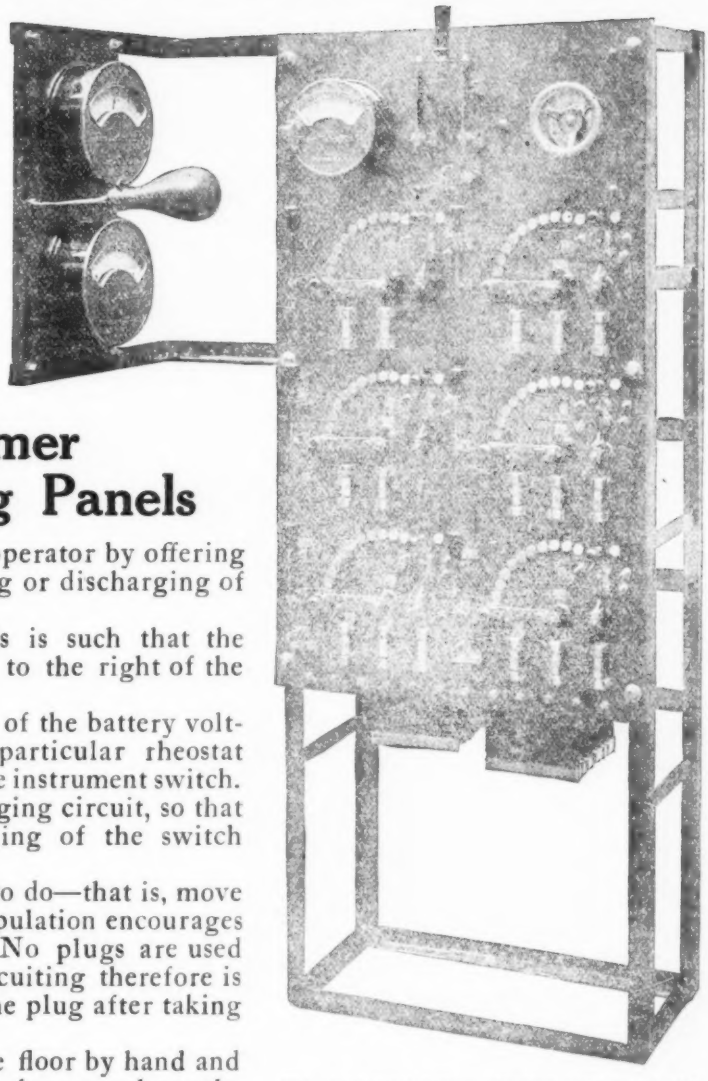
Every Facility for Correct and Efficient Charging of Electric Vehicles



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This six-rheostat battery charging panel has in addition, field rheostat switch and meters for a motor-generator set which was used with this particular panel for supplying the direct current for charging.

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